Technology and labour in japanese coal mining

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TECHNOLOGY AND LABOUR IN JAPANESE COAL MINING

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INTRODUCTION — RESEARCH OBJECTIVES AND CHARACTERISTICS OF COAL MINING

The coal industry produces an energy source for human society. Since the nineteenth century in particular, it has been a basic industry in the production of an energy source for modern nations which have undergone an industrial revolution. This paper examines the process by which Japan's coal mining was modernized during the period when Japanese capitalism was being established.

As will be discussed in detail later, modernization here denotes the introduction of machinery into coal mining to improve mining techniques. Moreover, as far as labour is concerned, it denotes a transformation of the traditional labour relationship to a rational one, thus corresponding to the modernized technology of coal mining.

Because the development of capitalism in Japan lagged far behind that of western nations, the coal industry in Japan could produce neither mining machinery nor large-scale mining technology independently, as did Great Britain. The modernization of coal mining in Japan, at least until the establishment of Japanese capitalism, thus primarily involved the transfer and implementation of mining machinery and large-scale modern coal-mining technology from industrially developed nations.

This paper, therefore, is intended to clarify the process by which the transfer and implementation of western coal-mining machinery and modern coal-mining technology was made in the course of the industrial revolution in Japan.

Coal mining is an industry involving the extraction of coal deposits,

which are mainly found underground. Consequently, it has several characteristics which are distinctly different from those of other industries, such as the manufacturing industry. An obvious characteristic is that coal mining is restricted to those areas where there are coalfields. Thus it is not rare to find coalmines in remote mountain areas far from the market. Second, the production mechanism of coal mining must be organized underground. As a result, the production of coal is governed to a large degree by various natural conditions such as the quality of the coal bed, geology, topography, and the earth's crust. Third, a stupendous cost is generally entailed in organizing and maintaining an underground mechanism as well as in overcoming various natural conditions. Fourth, the production mechanism must be moved as the location of coal extraction shifts because, in general, once coal from the surface strata has been completely extracted, the site must be moved gradually to deeper and deeper coal beds, with worse conditions.

These characteristics have prescribed the method as well as the development of coal mining in many ways. Coal production materializes upon the organization of a coalmine, which involves the following steps and operations: (1) detection of a coal bed as a prerequisite for the installation of a coalmine, (2) opening a mine toward the underground coal bed, (3) excavation and maintenance of a coalpit for the transportation of coal and people, (4) establishment of a coalface as the site for the extraction of coal, (5) transportation of coal, and (6) draining of water seepage and maintenance of ventilation.

The development of coal mining is synonymous with the development of this coal-mining mechanism. Since coal mining is an underground industry, it is organized as a collective operation whenever it is somewhat commercialized. As in the case of industrial development in general, the developmental pattern of coal mining reveals that, initially, coal mining started as a simple co-operative effort based on manual labour. This in turn led to somewhat more elaborately organized mining, still manual but with division of labour, comparable to that in small manufacturing industries. Lastly, mechanized coal

mining came into being.

Prior to becoming capitalistic ventures, coalmines were of the "manufacturing" type. Although manual labour was the major means of production for mines of this type, there was at this level an accumulation of independent coal-mining technology. Because the history of coal mining has been one of struggle against seeping water, cave-ins, and gases which resulted from the expansion of mining operations, coal-mining techniques involved nothing more than means to secure safety, to enlarge the operational scale, and to improve the drainage system.

The modernization of coal mining is in a large measure governed by these characteristics of the industry. Tremendous difficulties were encountered in facilitating the use of underground mining machinery and establishing and maintaining large-scale mining operations. Among obstructions to modernization were the low technological standard of machinery and the necessity of acquiring greater capital. Furthermore, these difficulties were compounded by such geological factors as excessive water seepage, faults due to shifts in the earth's crust, the poor quality of coal, and thin coal beds.

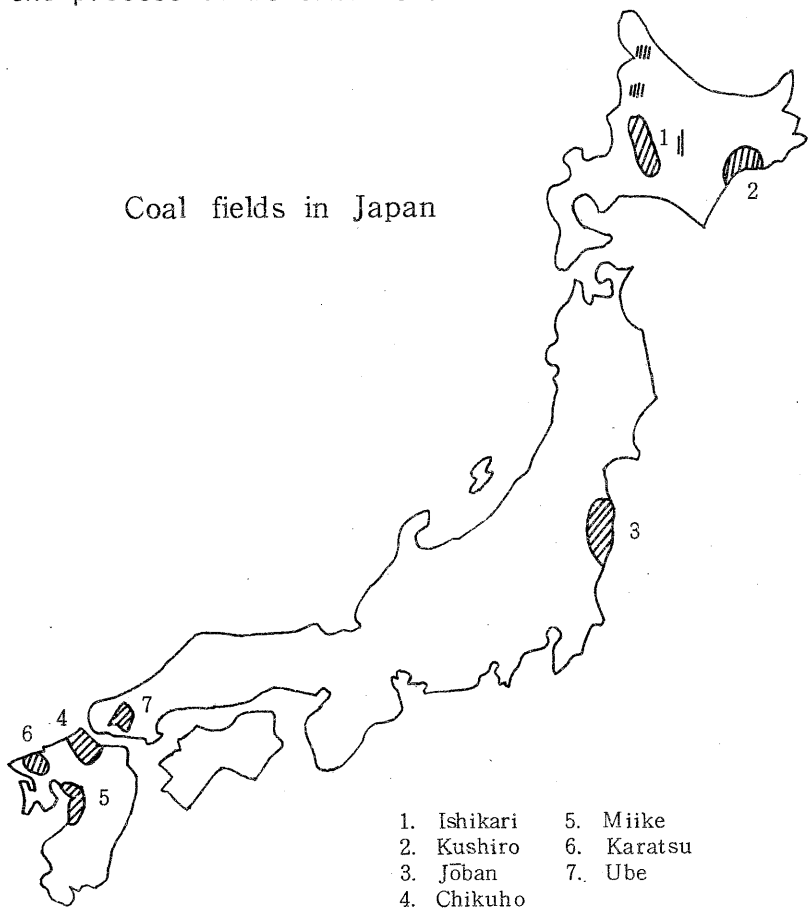
The modernization of the manufacturing industry resulted in a rapid increase in productivity once the operation was mechanized, as was seen in the spinning industry. In the case of coal mining, however, it was not until the twentieth century that the extraction process was mechanized. The mechanization of coal mining in the nineteenth century was limited to the drainage of seeping water, ventilation, and transportation, which formed only a small fraction of the entire process.

As a result, the modernization of Japanese coal mining was a partial and gradual process rather than a rapid one completed at a single stroke. It could not be modified drastically, therefore, even after the introduction of mechanization. In consequence, at the beginning of the modernization process, it was inevitable that there should be

a reliance upon traditional mining techniques. In the case of Japanese coal mining, the partial mechanization of drainage and coal transportation was an intiial step toward modernization. Modern coalmines, therefore, functioned mainly using endogenous technology. The process of promoting modernization was, in fact, one of upgrading and mechanizing the endogenous technology, as well as of the importation and diffusion of western large-scale coal-mining technology.

Taking the above factors into consideration, this paper examines the following aspects of Japanese coal mining: (1) the standard of the endogenous coal-mining technology which was the foundation and premise for modernization, (2) the policies undertaken by the Meiji government to modernize the coal-mining industry in Japan, (3) the actual process by which the Japanese coal-mining industry was modernized, and (4) the role played by both endogenous coal-mining technology and the labour system in the process of modernization.

Coal fields in Japan



1. Ishikari
2. Kushiro
3. Jōban
4. Chikuho
5. Miike
6. Karatsu
7. Ube

I. THE DEVELOPMENTAL STANDARD OF ENDOGENOUS COAL MINING

A Historical Outline of Endogenous Coal Mining

The endogenous coal-mining industry prior to the Meiji Restoration was insignificant in contrast to that existing in Japan after modernization or to that found in Great Britain prior to the industrial revolution. However, the endogenous coal industry in Japan had made some progress in the development of coal-mining technology and in its organization of skilled workers. Thus, the endogenous coal industry was not only the foundation upon which modernized coal mining was established after the Restoration, but also it served as a positive factor in promoting modernization.

The endogenous coal-mining industry, having a history of approximately 200 years, germinated in the late seventeenth century and continued until the 1880s. Its history can be roughly divided into four periods. The first period lasted from the end of the seventeenth century to the end of the eighteenth century; the second, from the end of the eighteenth century to the years just prior to the opening of the ports; the third, from the opening of the ports to the Meiji Restoration and the fourth, from the Restoration until the 1880s, by which time modern coal mining predominated.

This section briefly characterizes the developmental process of the endogenous coal industry up to the end of the third period. The germinal period of the endogenous coal-mining industry started at the end of the seventeenth, centring on what are now called Fukuoka and Yamaguchi prefectures. Although the use of coal had been common earlier, it was at the end of the seventeenth century that coalmines

were opened for the purpose of commercial production.

Due to a shortage of firewood in the region around Fukuoka Prefecture at the beginning of the eighteenth century, coal mining began to take on the distinctive features of an industry. This was because coal had come to be used as fuel not only for such purposes in home consumption as cooking and preparing baths but also for manual production, fishing fires, and salt manufacturing. The extraction of coal at that time was a form of part-time work for poverty-stricken peasants using primitive methods. They either picked an outcrop from a coal bed in between their agricultural work, or they dug a small adit into a coal bed using a method known as "badger burrowing" [tanuki-bori], abandoning it and starting a new one whenever water seepage began.

A new development in endogenous coal mining, however, occurred at the end of the eighteenth century. The use of coal for salt production, which was until this period limited to the northern Kyushu region, began to spread into the region of the Inland Sea, which was the centre of the salt industry. At that time, the Inland Sea region experienced a shortage of pine needles, which served as fuel in the salt-making process, and production costs, therefore, soared. Thus, coal, which was a low-cost fuel, was welcomed, and the coal industry began to develop rapidly from the end of the eighteenth century.

It was during this period that the primitive "badger burrowing" method was replaced by small manufacturing-type coalmines using some degree of coal-mining technology. Furthermore, professional coal dealers emerged, and they hired poverty-stricken peasants as day labourers specializing in extracting coal. The annual output of coal, which was no more than 40,000 to 50,000 tons at the end of the eighteenth century, had increased to 120,000 to 150,000 tons by the 1820s (see table 1).

New coalmines were excavated not only in Fukuoka Prefecture but also in the Karatsu region of Sage Prefecture and at various sites in

TABLE 1. Output of the Endogenous Coal-Mining Industry (rough estimate)

First period	End of the eighteenth century	40,000- 50,000 tons
Second period	1820s	120,000-150,000
Third period	1860s	300,000-400,000
	Chikuzen	40,000
	Buzen	20,000
	Hizen	120,000
	Ube	30,000
	Miike, Takashima	80,000
		370,000

Calculated from various sources.

Nagasaki Prefecture. The clan governments of the coal-mining regions took notice of the developing industry and set forth regulations. Because they controlled the coal-mining industry and exploited much of the profits, they suppressed the capitalistic development of the coal-mining industry.

The opening of the ports brought to the endogenous coal-mining industry a new development. Supplying coal to foreign steamships coming to Japan expanded the coal market tremendously and caused the Japanese coal industry to come in contact with the industrial revolution as well as the world market. The possession of steamships by the shōgunate and the feudal clans also contributed to the expansion of the coal market. The opening of the ports thus stimulated the development of Japanese coal mining.

TABLE 2. Coal Output in Chikuzen

Year	Output (tons)
1788 (Tenmei 8)	18,000
1804 (Kyōwa 1)	33,000
1826 (Bunsei 9)	28,000
1837 (Tempō 8)	40,000
1839 (Tempō 10)	38,000
1867 (Keiō 3)	36,000

Note: Data for 1788 and 1804 formulated from Nōgata-shi Shi, vol. I, pp. 597 and 607; for 1826 onward from Fukuoka-ken Shi, vol. II, book 2, pp. 260, 268 and 356.

Coal mining in the Chikuzen region in Fukuoka Prefecture, which

previously had been the centre of the coal industry, stagnated due to the limited transportation capacity of the Onga River and higher costs due to the greater depths of the coal mines there. Instead, the coal industry in the Karatsu region, which extracted coal from upper strata, grew rapidly. Moreover, its growth was enhanced further because its proximity to Nagasaki shortened the transportation distance between the coalmine and the mouth of the river. The annual output of coal in the Karatsu region reached as high as 180,000 tons in the 1850s. Furthermore, the Miike Coalmine in the Higo region of Fukuoka Prefecture and the Takashima Coalmine in Nagasaki Prefecture developed into large-scale coalmines as they were endowed with good quality coal as well as other favourable conditions. Annual output increased to approximately 300,000 to 400,000 tons in the 1860s.

The Developmental Standard of Coal-Mining Technology in the Endogenous Coal Industry

In comparison to the modern coal industry, the endogenous one was certainly limited in terms of size of market, management scale, and coal-mining technology. It should also be remembered, however, that existing coal-mining techniques had been nurtured over a period of a century. In the past, researchers dealing with the history of coal mining often regarded such coal-mining techniques on the whole to be of the "badger burrowing" type. Those views, however, are incorrect. Consequently, this section intends to follow the developmental process of the techniques used in the endogenous coal industry and then to clarify the standard reached by the end of the Tokugawa period.

Coal-mining methods from the end of the seventeenth to the middle of the eighteenth centuries were either to pick an outcrop on the surface of the coal bed or to rely upon the so-called primitive method of "badger burrowing" by digging an adit into the surface of a coal bed.

By the end of the eighteenth century when the coal industry was being firmly established, however, there were certain improvements made

over this so-called "badger burrowing" method and more advanced coal-mining techniques were beginning to be formulated. For example, Seihyo Kizaki, who depicted the coalmines at Karatsu at the end of the century in his work, The Produce of Hizen (Hizen bussan-kō), presented an interesting description which reveals some of the coal-mining methods and techniques of the time.

Kizaki's description reveals that certain classifications with regard to geology and the quality of the coal bed had been devised. Such knowledge is necessary prior to excavation. Kizaki stated that coal found in a deep bed was of good quality and classified different beds into "surface coal," "secondary coal" and "bottom coal." Some knowledge concerning geological formation is also shown by the use of such terms as "ceiling rock," "clay-type" and "boundary stone" in denoting various strata. Moreover, Kizaki stated that because coal-mining sites varied from province to province, excavation was preceded by close examination of a mountain based on knowledge regarding coal beds, geology and topography.

As far as coal-mining methods were concerned, Kizaki recognized the existence of three distinct types which involved: a pit, an adit or an inclined shaft. A pit was dug by the so-called "draw digging" (tsurabe-bori) style which meant that coal was drawn to the surface with a basket from an adit connected to a pit. An adit was dug "straight into the foot of a mountain when coal was detected" and an inclined shaft known as a "runner" (hashirikomi) was dug "at any estimated sites when coal is found at the foot of a mountain and then dug horizontally." The use of these methods to open mines required knowledge of an extremely specialized nature. They were based upon knowledge concerning coal beds, geology and topography, and regulated the actual methods of coal mining.

According to Kizaki, "Numerous drifts are dug to the left and the right of the initial adit wherever it is possible to extract coal." Although the method was primitive, one can see that it was similar to the chamber style whereby the main coalpit was dug initially, and then

adits were extended to the left and right. The use of pit wood for the maintenance of the coalpit is also mentioned, for he stated that "pit wood is firmly set before digging further." There is also indication of a primitive pillar technique, because "at a spot where the foundation is not solid, coal is left uncut to form a natural pillar." This is part of an important description not only concerning the coal-mining techniques used by pitmen to cut the coalface with picks, but also revealing how efficiently coal could be extracted from a coal bed.

One of the greatest obstacles encountered by the endogenous coal-mining industry was the fact that the deeper the coalface, the more water seepage occurred, and thus there were always problems concerning drainage techniques. In addition, the labour required for drainage caused the cost of coal to rise.

Seeping water was drawn with a well bucket just as coal was drawn from the pit. In an inclined shaft, seeping water collected in the sump was pumped up gradually from one level to another through the use of a hand suction-pump. As drainage using a suction-pump became difficult in a deep winding shaft, a canal pit was opened specifically for the purpose of "draining water by digging a ditch." In an adit, "rather than lowering the level of the adit as it is dug," a certain angle was maintained so that seeping water was drained out naturally. Such drainage techniques coupled with the methods of opening mines comprised the major coal-mining techniques.

In the absence of any specific description, it is assumed that they simply relied upon natural ventilation, while the lighting system in a coalpit was achieved by "lighting onto a turban shell."

Coal was drawn up from a pit with a basket. In cases where coal was to be brought out from an adit or an inclined shaft, a bamboo basket was used which was either pulled or carried on the back of a putter, which was a simple operation. Four-wheeled carts were also used for carrying the coal inside and outside the coalpit.

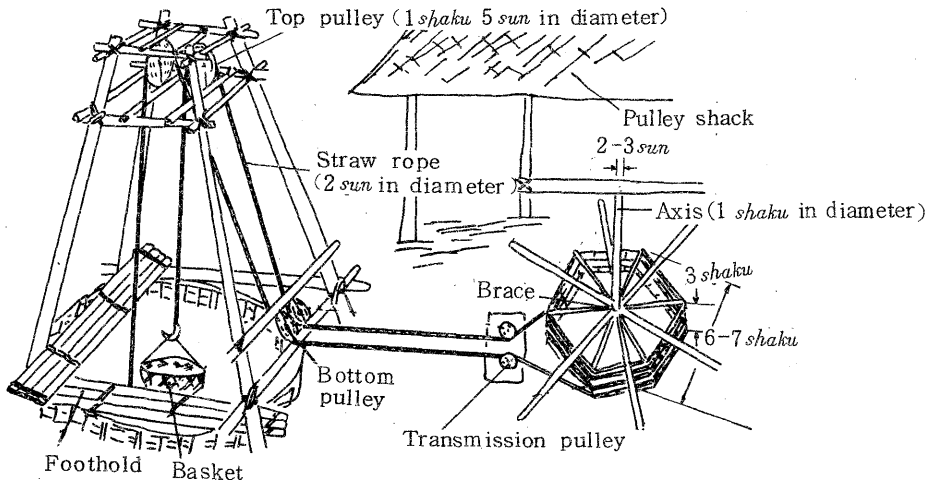
Thus from the above description by Kizaki, the formulation of certain primitive coal-mining techniques can be understood. Although the standard of coal-mining technology has not necessarily been clarified from all perspectives, the above could be considered the prototype of the basic techniques employed in the endogenous coal-mining industry.

There was a marked development after entering the nineteenth century, as the coal market gradually expanded and the further accumulation of coal-mining technology was accomplished. As upper coal beds became exhausted in such developed regions as Chikuzen, coalmines became slightly larger with deep beds using innovated coal-mining techniques. However, creating large-scale coalmines was a rather difficult task due to the effects of the rainy season, the geology of the coal beds and Japan's topography. There was the added tendency for output gradually to decline as the operation was enlarged. In consequence, the majority of endogenous coalmines were of an extremely small scale. Moreover, the length of the coalpits ranged from a short 30 metres to longer ones which did not exceed 120 to 130 metres. The number of pitmen ranged from several to a maximum of 20 to 30.

Coal-mining techniques were, nevertheless, improved to some degree by the end of the Tokugawa period. Taking drainage techniques as an example, a hand pump which was more effective than a suction-pump had come into use. A water wheel was also used. There was the so-called "pulley from the south" which had been invented by a coal dealer of Ube in Yamaguchi Prefecture in 1840 (Tenpō 11) that had come to be used in the pits. It was a hoisting machine using pulleys. This made it possible to work in pits as deep as 30 metres while conventional pits were no more than six to nine metres deep. When the scale of the mines was somewhat expanded, it became customary to dig a canal pit for drainage. At a mine in Buzen, for example, it was recorded that a drainage pit 1,242 metres in length was dug in 1859 (Ansei 6) through the connection of several pits. Coalmines with independent pits for ventilation also began to appear at this time.

What is noteworthy with regard to the innovation of coal-mining

Pulley from the south



From *Yamaguchi Tanden Sanbyakunenshi*, p.13.

technology was the transfer of metal-mining technology to the coalmines. The history of metal mining was longer than that of coal mining, and thus more advanced techniques existed. According to data from the Ono family, who were coal dealers for the Yanagawa clan, a metal miner was invited to work on the extraction of coal at the Miike Mine at the beginning of the nineteenth century. The memoirs of this metal miner reveal that "wood timbers are used to support the ceiling and a hand pump is operated day and night to scoop out the seeping water." Furthermore, it was stated that "the 'weep' ditch is cut up to the sump which is situated under the main chamber." Ventilating tunnels were dug "connecting the chamber to the outside with the use of supporting timbers placed so as to make (the tunnels) square in section." It was pointed out by the writer that "although both are quite costly, such measures are indispensable in order to ensure efficient operation in the main chamber."

The formation of large-scale mines and techniques at the end of the Tokugawa period deserve special attention. Large-scale mines were established in regions where favourable conditions such as easy accessibility and high quality coal existed.

The Takashima Coalmine, situated on an isolated island about 15 kilo-

TABLE 3. Output and the Number of Miners at the Takashima Coalmine (Estimate) [1855 (Ansei 2)]

Pit Names	Output (tons)	No. of miners
Total for the three Pits at Takashima	24,900	410
Hiroiso	14,200	230
Hyakumazaki	8,600	120
Nakayama	2,100	50
Kayakijima Coalmine	8,600	120

Source: Data from Matsu no Ochiba

metres away from the port of Nagasaki, was already recognized as a large-scale coalmine due to its annual output of approximately 8,000 tons at the end of the century. The mine was under the control of the Saga clan from the beginning of the nineteenth century. According to a survey conducted in 1855 (Ansei 2) by Motojima, a retainer of the Saga clan, the mine had become so large that its annual output was about 20,500 tons. The coalmine consisted of three shafts with four contractors under whom, judging from output, there were about 400 miners. According to Motojima, the Hyakumazaki Pit lay 180 metres underground, reaching the sea floor, and its drainage system consisted of 24 layers of water wheels.

In addition to the above, a Dutchman who visited the Takashima Coalmine in 1858 (Ansei 5) related that he reached the coalface of one of the pits after walking downward from the pit entrance for 25 minutes. The seeping water was drained by water wheels operated by hand and foot and "it was kept in very good condition." He also commented that "the Japanese already have sufficient knowledge of the necessary safety measures required for this enterprise."

Both accounts of the Takashima Coalmine provide sufficient indication of its large scale. Technically, those who backed this mine were the contractors and the skilled pitman. F. Potter, a British mining engineer, who surveyed the Takashima Coalmine in 1871 (Meiji 4), was able to complete his task with the cooperation of local engineers who were familiar with the topography and coal bed. He paid close attention to the opinions of the local engineers during the survey and

evaluated highly their knowledge and technology. Thus it can be seen that better coal-mining technology was being developed at the Takashima Coalmine than that found in conventional small-scale mines.

The same could be said with regard to the Miike Coalmine which comprised the Mount Hirano area in the domain of the Yanagawa clan and the Mount Inari area in the domain of the Miike clan. Each had a long history and had developed into sizable mines by the beginning of the nineteenth century. Several contractors were employed by the Yanagawa clan to manage the mine on Mount Hirano. By 1868, 30 pits were abandoned; six were in operation. It was a large mine with an output of 30,000 tons in 1864. An estimate of the size of coalmines in the early Meiji period indicates that there were five to six pits ranging in length from 200 to 300 metres to over 1,000 metres. These were in constant operation with several hundred miners working in them.

TABLE 4. Coal Output of the Miike Mount Hirano Coalmine

Year	Output (tons)
1864 (Ganji 1)	30,000
1865 (Keiō 1)	27,000
1866 (Keiō 2)	22,000
1867 (Keiō 3)	24,000
1868 (Meiji 1)	18,000
1869 (Meiji 2)	23,000
1870 (Meiji 3)	34,000
1871 (Meiji 4)	26,000

Source: Data formulated from Fukuoka-ken Shi, vol. III, pp. 357 and 381

The coalmine on Mount Inari was of this type. The Ōura Pit of Mount Inari was so large that excavation took three years starting from 1855, and it remained in operation until the early Meiji years. As will be seen later, this coalmine was big enough to co-exist with modern mines.

Large-scale coalmines established in the Chikuhō and Karatsu regions were identical to the Takashima and Miike Coalmines. As mentioned above, coal-mining techniques found in large-scale mines at the end of the Tokugawa Period were developed from conventional techniques existent at the end of the eighteenth century. However, they were far

more sophisticated than the "badger burrowing" method. The primitive chamber and pillar methods were improved and made more systematic and rational. Thus the technology of the endogenous coal-mining industry was such that it continued to be used in the operation of primarily modernized coalmines which used machinery for transportation and drainage. Japanese coal mining, therefore, was not initiated by the transfer of western technology, nor was it modernized only after the transfer was made. At least as far as preliminary modernizing efforts are concerned, the endogenous technology formulated by large-scale coal mines was instrumental in the modernization of the Japanese coal-mining industry.

Management and Labour in the Endogenous Coal-Mining Industry

The creators of the endogenous coal-mining technology, as mentioned above, were professional workers composed of management on the one hand and skilled miners on the other.

The operation of coalmines up to the end of the seventeenth century was no more than a source of part-time work for poor peasants during the agricultural slack season. At the beginning of the eighteenth century, however, managers began to hire workers on a wage basis. Professional miners working for wages appeared in the middle of the eighteenth century and management levels were clearly established.

Those who became managers came from all walks of life — peasants, village headmen, and sometimes men of the warrior class. However, due to the fact that the clan governments of the coal-producing regions gained firm control over mines in the nineteenth century, the form of management became complicated as the conventional free management of coalmines was restricted.

The Fukuoka clan established a policy whereby only local villagers were allowed to become mine managers and they were generally addressed as "yamamoto" [mountain owner]. It was possible, therefore, for any

local villager to become a manager. However, as will be explained later, should a skilled miner from another clan be made foreman (tōryō) of the coalmine, actual management would be carried out by him while the local "mountain owner" existed only on paper. Similar conditions prevailed in other clans. In the Karatsu clan, managers were addressed as "motokata". Powerful "motokata" would hire a number of subcontractors. Moreover, the clan governments often managed their mines directly, hiring contractors for actual supervision. Those who became contractors for the clan governments were usually coal dealers and skilled miners.

Whatever the form of management, it was indispensable to have specialists who knew all about mining technology, in order to organize and supervise the mine. When a manager was not a specialist, a contractor with knowledge of mining techniques was hired to run the mine. The contractor system in the coal-mining industry, to be known as the foreman system (tōryō-sei), was thus established at the beginning of the nineteenth century.

The accumulation of coal-mining techniques was made possible only through the improvements made by such specialists as the "mountain owners" and foremen. A good indication of the range of their knowledge is revealed through an account of the coal beds existing in the Chikuzen region given by a manager in the 1850s, which coincided more or less with survey results published by the Bureau of Fukuoka Mining Superintendence in 1903 (Meiji 36). As stated above, the managers and foremen of the Takashima Coalmine and the Miike Coalmine possessed such advanced coal-mining techniques that they were able to contribute to modernization projects in the mines.

As far as the miners were concerned, a group of professionals emerged in the middle of the eighteenth century. By the end of that century, groups of miners from other regions and villages were formed. Although local villagers were still hired as pitmen by the owners, various data reveal the fact that a group of free and migrant skilled miners specialized in coal mining began to emerge at the end of the

eighteenth century. A contemporary book dealing with coal mining stated "those who extracted coal are not necessarily local peasants but are coalminers who are said to move around different provinces. They examine mountains and buy up a mountain when they detect a coal bed."

The existence of such specialized miners was not necessarily approved of at first. The clan governments, however, came to authorize, with restrictions, the existence of specialized coalminers and miners from other provinces. This was done to promote the coal industry as a means to gain further profit as well as a measure for the betterment of the poverty-stricken peasants.

Although freedom of employment under the Tokugawa regime was generally limited, as was the case with the metal-mining industry, from the beginning of the nineteenth century the clan governments allowed a relatively free pattern of employment with regard to coalminers. The Fukuoka clan, for example, put forth the following employment policy in its regulations issued in 1838 (Tempō 9) pertaining to the coal industry: (1) should a travelling miner (a miner from another province) be hired, the supervisory official of the coalmine must inquire into his background and authorize his employment when a poll tax of 12 mon is paid by him; (2) should a local villager desire to work in the coalmine, in principle he must be single. His circumstances must be investigated by the village headman. When it is certified that his employment by the coalmine will not hinder either agricultural affairs or the village administration, approval can be granted by reporting to the county headman; (3) a peasant with a family can also be hired after throough investigation using the same procedure; (4) the pitmen and daily labourers should generally be isolated from the villagers and thus a bunkhouse system (naya seido) is authorized for the purpose of their accommodation.

Other clan governments put forth similar regulations. Together with the development of the endogenous coal industry from the middle of the nineteenth century to the end of the Tokugawa period, a professional

group of relatively free travelling miners was formed. Local peasant miners also grew in number.

For example, although the number of travelling miners in Chikuzen province was said to have been small, records of a coal-mining village reveal that "there are many boatmen and coalminers from other villages living in this village." Other data also show that there was a considerable number of travelling miners in this province.

The coal industry in Karatsu was able to attract many experienced foremen and skilled miners from the more advanced coal region of Chikuzen. Many miners working in the Karatsu region therefore came from Chikuzen. A study of the background of those who worked at three mines in Karatsu in 1862 (Bunkyū 2) reveals that those coming from the local province of Hizen accounted for only 26.3 per cent while those from other provinces comprised 73.7 per cent of whom 31.5 per cent were from Chikuzen province. Various data reveal that they were hired quite freely and migrated from province to province. Thus a labour market for coal workers had developed by the early nineteenth century, and there existed a group of wage-earning miners. Some, who might have originally been local peasants, must have migrated to better-paying mines after learning the necessary mining skills. Others were landless peasants who came to work in mines after taking up various other waged jobs. Judging by the output of coal, the number of such miners in the 1860s is estimated to have been between 7,500 and 8,000.

Among the skilled miners were to be found the bearers of coal-mining technology and the reserve corps of future foremen and managers. It is recorded that by the end of the Tokugawa period, there were miners for whom mining had been a family profession for generations. Such miners who had worked in coalmines since childhood became skilled miners and the endogenous coal industry produced many such skilled workers. Furthermore, not only did they help promote the modernization of coal mining after the Restoration but they also contributed to the development of the endogenous coal industry. If a cluster of skilled

TABLE 5. Home Provinces of the Miners in the Karatsu Region

	No. of Miners	Percentage
Hizen	10	26.3
Hirado	3	
Nagasaki	2	
Shimabara	2	
Chikuzen	12	31.5
Buzen	2	
Bungo	1	
Higo	1	
Yanagawa	2	
Ōmura	1	
Tsushima	1	
Chōshū	1	
	38	100.0

Source: Data formulated from Karatsu Han Sekitanshi no Kenkyū by Motokichi Higaki

Note: The above figure of 38 miners consisted of miners working for three mountain owners, of whom 30 had families. 46 of these family members apparently worked for the coalmines while eight did not.

miners had not been formed in the endogenous coal industry, there would have been no labour force for the modern coalmines. In that case, it would have required a great deal of time for a newly-hired labour force to adjust and acquire various coal-mining skills.

II. THE DEVELOPMENT OF MODERN JAPANESE COAL MINING AND GOVERNMENT POLICIES

The Development of Modern Japanese Coal Mining

After the Meiji Restoration, Japanese coal mining developed rapidly due to the introduction of various changes. The development of capitalism in Japan was a principal factor in the development of the coal industry, as it created an extensive modern market for the consumption of coal.

With the modernization of the Takashima Coalmine in the early Meiji years and then the Miike Coalmine in the 1880s, the endogenous coal mines gradually came to be modernized. The Chikuho region, which had been the centre of the coal industry in Japan, began to modernize its coalmines in the 1880s. By the 1890s, modernized mines predominated in the region. It was during this period that mines in other parts of Japan, such as Nagasaki, Hokkaido, Joban and Ube, were gradually modernized.

The annual output of coal in Japan, which was no more than about 500,000 tons in 1877 (Meiji 10), increased to 1,700,000 tons in 1887 (Meiji 20), 5,200,000 tons in 1897 (Meiji 30) and 13,900,000 tons in 1907 (Meiji 40).

The size of the coal market grew simultaneously. While in 1887 (Meiji 20) as much as 47.6 per cent of the coal was consumed by the endogenous salt-making industry, 10 years later this consumption rate had decreased drastically to 13.9 per cent. On the other hand, coal consumption by railways and modern industries using steamships and steam engines rose from 52.4 per cent in 1887 to 82.1 per cent 10 years later.

TABLE 6. Transition in Nationwide Coal Output

Year	Output (10,000 tons)	Year	Output (10,000 tons)
1874 (Meiji 7)	20.7	1893 (Meiji 26)	331.9
75 (8)	56.7	94 (27)	426.8
76 (9)	54.4	95 (28)	477.2
77 (10)	49.9	96 (29)	501.9
78 (11)	67.9	97 (30)	520.7
79 (12)	85.7	98 (31)	673.8
80 (13)	88.2	99 (32)	675.1
81 (14)	98.5	1900 (33)	747.1
82 (15)	92.9	01 (34)	901.0
83 (16)	100.3	02 (35)	979.8
84 (17)	113.9	03 (36)	1016.9
85 (18)	129.3	04 (37)	1080.6
86 (19)	137.4	05 (38)	1163.7
87 (20)	174.6	06 (39)	1308.3
88 (21)	202.2	07 (40)	1393.9
89 (22)	238.8	08 (41)	1497.9
90 (23)	262.8	09 (42)	1504.8
91 (24)	317.5	10 (43)	1568.1
92 (25)	317.5	11 (44)	1762.3

Source: Data from Nippon Kōgyō Hattatsushi, ed. by Konwakai, vol. II, pp. 172-174.

TABLE 7. Coal Consumption in Percentage According to Use

	Marine	Railway	Factory	Salt Making
1887 (Meiji 20)	30.3	2.4	19.7	100.0
92 (25)	25.1	6.9	42.4	100.0
97 (30)	24.8	9.7	51.6	100.0
1907 (40)	27.2	12.1	51.7	100.0

Source: Data from Nippon Tankōshi, 1901 edition by Mototarō Takanoe, p. 61.

The rapid development of the coal industry was no doubt due to the efforts of both the owners and miners. Let us, however, examine the policy of the Meiji government pertaining to the modernization of the coal industry.

Meiji Government Policies Regarding the Modernization of Mining

Japan's modernization lagged behind that of the western nations. In the case of capitalistic late-comers, government policy plays a principal role in the process of industrial modernization. The Meiji government, therefore, played an important role in the modernization

of Japanese coal mining.

Once the new government was firmly in power, it abolished the traditional regulations pertaining to mining and announced in rapid succession new modernization policies. The basic direction of the government's policy was as follows: (1) to create a bureaucratic mining organization, (2) to establish a legal order governing modern mining, and (3) to establish government-owned mines, or to support the modernization of privately-owned mines.

The new policies concerning mining as set forth by the Meiji government are characterized by the fact that the government initially employed foreign mining specialists, engineers, and skilled miners in order to bring about modernization. It also pursued the independent development of Japanese mining by nurturing Japanese mining scientists, engineers, and skilled miners.

The Meiji government took over the copper monopoly in Osaka which had belonged to the Tokugawa regime in February 1868 (Meiji 1) and re-opened it as the Bureau of Mining (Kōzan-kyoku) in July. In October, upon the establishment of the Ministry of Engineering, the Department of Mining (Kōzan-gakari) was created. The bureaucratic organization thus took form gradually. In order to accomplish modernization, the government employed foreign scholars and engineers, starting with a French mining engineer, F. Coignet, in September 1868 (Meiji 1). Others who contributed greatly to the modernization of mining were a Briton named Pall who arrived in 1868 (Meiji 2), a German geologist, Ochen, who came in 1871 (Meiji 4), and a British chief engineer, Godfrey, who arrived in the same year. By 1884 (Meiji 17), there were as many as 78 foreign engineers.

In order to train modern mining bureaucrats, the government employed the competent endogenous mining scientist, Takatō Ōshima. Other capable eningeers were also employed as bureaucrats so that they could acquire modern mining technology and skills either under the guidance of foreigners employed by the government or by going abroad.

Based upon a recommendation made by Takatō Ōshima, the School of Engineering (Kōgakuryō) opened in 1871 (Meiji 4) and, similarly, the Department of Mining of the College of Engineering (Kōbu Daigakkō) was established in 1873 (Meiji 6). The latter played an especially important role in training modern mining bureaucrats.

These bureaucrats, in turn, cooperated with the foreign scholars and engineers to draft legislation for modern mining laws. The government also abolished the traditional gold and silver monopoly of the Tokugawa government in 1869 (Meiji 2). The management of mining was thus generally liberalized, although a permit from the local government was required. Furthermore, the government abolished the monopoly system of the clan governments which hindered the free development of the coal industry.

The first modern mining legislation compiled by the Meiji government was the Japanese Mining Act (Nippon kō-hō). This was drafted in September 1871 (Meiji 4) by Tōru Yoshii, a high-ranking mining bureaucrat and J. Godfrey, the British mining engineer employed by the Ministry of Engineering.

The Japanese Mining Act consisted of eight chapters and 33 articles. It was a systematic law which was essential for the modernization of Japanese mining. The main items of the Act were as follows. First, government ownership of all minerals was proclaimed by stating that "minerals which belong to the Japanese government are extracted solely by the government." Thus, individual mines were leased by the government and managed under its supervision. This regulation was contrary to the practice followed in Britain where the private ownership of minerals was recognized. This, nevertheless, was a strategic measure taken by the government in order to facilitate governmental involvement. Second, the management of mines by foreigners was prohibited by stating that "no one without possessing Japanese nationality is permitted to attempt digging, lease a mine, operate a mineral refinery or become part of the management." This regulation was significant in the sense that the government aimed at the

independent management and maintenance of mining by preventing inroads of foreign capital into the mining industry. Third, the Japanese Mining Act set the lease term at less than 15 years with a minimum area of 500 tsubo. This was aimed at encouraging mining management by private citizens with small capital. However, the regulation concerning the minimum area of 500 tsubo caused fragmentation of mining management, random mining and the destruction of resources. The government, therefore, revised this regulation in 1882 (Meiji 15) by expanding the minimum mining lease area to 10,000 tsubo.

The Japanese Mining Act was responsible for many ill effects. For example, it was difficult for large capital to be invested when the lease term was valid for only 15 years, and this caused managers to mine excessively within the leased area. Consequently, the government enacted the Mining Regulations (Kōgyō jōrei) in 1890 (Meiji 23) which modified many of the irrational rules which had been set forth in the Japanese Mining Act. These Mining Regulations were drafted by the emerging mining bureaucrats.

Noteworthy among the concrete mining policies of the Meiji government are the nationalization of the major mines, the employment of foreign engineers, the importation of foreign machinery by the government, and the transfer of advanced western mining technology in order to modernize Japanese mining. In addition, the government nurtured and trained Japanese mining specialists, engineers and miners at mines during the above-mentioned modernizing process.

In the case of the coal-mining industry, however, the government did not always apply its general policy of nationalization. Government-owned coalmines, such as the Takashima, Miike and Horonai mines, were exceptional cases due to their special circumstances. The modernization of metal mining, promoted by the government, was also important for the coal-mining industry. Japanese mining specialists, engineers and miners who were trained during the modernization of metal mining also contributed to the modernization of the coal industry.

The Meiji government invited foreign scholars and engineers to lecture at the newly opened Department of Mining in order to train Japanese mining specialists and engineers. The government established the College of Engineering in 1873 (Meiji 6) by modifying the School of Engineering. The college comprised the Department of Mining and seven other departments. The curriculum included two years each of preliminary studies, specialized studies and practical work, totalling six years of education. Special attention should be paid to the practical education which lasted two years. The Department of Mining produced 48 graduates before being amalgamated with the Imperial University in 1885 (Meiji 18). These graduates were the harbingers of the modernization of Japanese mining at the university level, in the government bureaucracy and in the mining industry. Some of them became actively engaged in the coal-mining industry.

As in the case of other industries, the government was intent on rapidly producing trained mining specialists, bureaucrats and engineers so that foreign staff members, who had been leading the modernization effort, could be replaced. Japanese specialists therefore made the independent development of the mining industry possible. Although their knowledge and technological skills were limited, they played a significant role in Japan's modernization which was guided by an ideology and policies which aimed at independent management of the industry by the Japanese.

Lastly we come to the major government policies directly aimed at the coal industry. One was the nationalization of the Miike Coalmine and its modernization by the government. The government established the foundation of modern coal mining in Japan with the nationalization of the Miike Mine in 1873 (Meiji 6) and by undertaking its modernization in the late 1870s. The other was the enforcement of a selective mining area system in the Chikuhō region. The administration, which had grown apprehensive because of the scattered mining areas and random mining by small-scale enterprises in the Chikuhō region, amalgamated the mining areas of successive coal beds and then divided them into 34 districts. Thus only large-sized mining districts could be leased out.

This policy ensured the management of large-scale coal mines by large capital, which rectified the existing conditions, thereby enhancing the modernization of the coal industry. A variety of government policies thus contributed to the modernization of the Japanese coal-mining industry.

III. THE MODERNIZATION OF TWO MAJOR ENDOGENOUS COALMINES DURING THE FIRST HALF OF THE MEIJI PERIOD

The Modernization of the Takashima Coalmine During the Early Meiji Period

(1) An Attempt to Modernize the Takashima Coalmine and the Establishment of a Joint Venture

It was the Saga clan which first attempted to modernize coalmines. Naomasa Nabeshima, the lord of the clan, was not only a progressive thinker but was also very calculating. Upon seeing an increased demand for coal since the arrival of the black ships, he became intent on developing the coal industry as a means to help restore the financial condition of his clan. He ordered Shōin Motojima to investigate all the clan's coalmines in 1855 (Ansei 2). Naomasa subsequently allowed the Dutch Navy to survey the Takashima Coalmine in 1858 (Ansei 5). At about the same time, he also accepted a suggestion made by Dutch engineers to modernize the endogenous coal-mining system based upon their analysis of it. W. Kattendyke, who took part in the survey, criticized the manual drainage system used at the Takashima Coalmine and wrote in his diary that he recommended "the immediate installation of the coal-mining machinery that has already reached Japan so that the coal and the seeping water can be brought up to the surface level using steam power."

What should be noted here is not the fact that the recommendation regarding the modernization of the coalmines was made by a Dutchman, but the fact that the Saga clan had already purchased steam-powered hoisting machines and pumps in 1858 (Ansei 5) in order to modernize its coal mines. This plan, however, did not materialize. R. Alcock,

the British consul at the time, pointed out that this might have been due to opposition on the part of the lord who thought that the introduction of machinery would lead to unemployment. Alcock, however, went on further to point out that there could have been pressure from the shōgunate to abandon the project. The first reason can be dismissed as being doubtful; thus the second theory appears more likely. In addition to shōgunal opposition, the failure to instal the recommended machinery could be attributed to the fact that it was difficult to find engineers who could give guidance on the management of modern coalmines.

Naomasa Nabeshima in January 1868 (Keiō 4) decided once again to pursue modernization of the Takashima Coalmine. The policy of the Saga clan was to aim for modernization by establishing a joint venture with foreign capital due to its lack of both sufficient capital and foreign engineers. Furthermore, it would have been more difficult for the Tokugawa government to interfere with a joint venture.

Subsequently, the Saga clan succeeded in making contacts with a British merchant, T. Glover, who played a unique role in the politics and trade of Japan at the end of the Tokugawa period. Glover signed a contract with the Saga clan in 1868 (Keiō 4) to develop the Takashima Coalmine jointly.

The following were the main points of the contract: (1) The development cost shall be equally shared by both parties. The expenses, however, already encountered by the Saga clan for the purchase of mining machinery (approximately 6,500 ryō) shall be counted as a part of their investment. (2) However, due to the inability of the Saga clan to invest any capital initially, Glover shall provide the entire investment cost and five per cent of the return from the sale of coal shall be paid by the Saga clan in order to repay the debt. (3) The profit shall be equally divided. (4) Glover shall be primarily in charge of the sale of coal and will also supply the necessary foreign engineers. (5) The Saga clan shall be primarily in charge of the management of the coalmine. (6) The term of contract shall be limited to seven years.

(2) The Modernization of the Takashima Coalmine as a Joint Venture

(a) The Development of the Hokkei Pit

Upon signing the contract to establish a joint venture, Glover and the management office employed a British mining engineer named Morris in May 1868 (Meiji 1). A pit which was later named the Hokkei Pit was opened in the northern section of Takashima under his instruction. In April of the following year, excavation began at the Hasshaku coal seam, which was located at the top layer of the Takashima coal bed. A coal-hoisting machine and a drainage pump were powered using a steam engine. The Takashima Coalmine thus started operation as the first westernized coalmine under the guidance of a foreign mining engineer.

While the Takashima Coalmine has been recognized as the first westernized coalmine in Japan, little is known regarding the circumstances of its modernization, and this aspect shall be examined in this section. In short the Takashima Coalmine from 1868 (Meiji 1) until about 1874 (Meiji 7) when it was nationalized, was a small-scale, western-style coalmine with partial modernization limited to the pit areas. The introduction of western large-scale mining methods was, therefore, extremely rare.

One source reveals that the pit was three metres in length, 2.4 metres in width and 47 metres in depth. In comparison to other endogenous pits, the scale of the Hokkei Pit was not very large, for the ones in the Ube region usually reached a depth of 30 to 40 metres. Moreover, it was somewhat smaller than the modern pits which came into existence later.

The main problem, therefore, involved the level of mechanization and the capacity of machine power. In the case of the Hokkei Pit, the mechanization of coal transport and water drainage was limited to the pit area. In the adit area, both coal transport and water drainage depended upon manual labour. Ventilation was not mechanized and

abandoned pits became the source of ventilation. Machine power capacity at the time is difficult to surmise. As far as the drainage pump was concerned, a small seven-inch model was used. Although the horsepower yielded by the caged hoisting machine is unknown, it is estimated that it could not have lifted more than a one-ton coal cart. Even though tracks for one-ton coal carts were installed for the transportation of coal from the mine to the pier, transportation still depended upon manual labour.

Although the background of the British engineer, Morris, is not known, judging from his work, he could not have been a first-rate mining engineer. There was also a miner by the name of Harrent who was given the title of foreman but his level of skill is again unknown.

The above illustrates that the interior of the coalmine was not modernized, as was the case with Britain's coalmines. While endogenous coal-mining technology was sufficient for the extraction of coal when mechanization was so limited, it is assumed that modern British methods were gradually applied for the excavation of drifts and the setting up of a coalface.

One source reveals that the daily output of the Hokkei Pit was 120 tons, indicating an annual output of approximately 40,000 tons. This figure also indicates the small size of the Kita Tanii Pit.

(b) The Development of the Nanyō Pit

Glover went bankrupt in August 1870 (Meiji 8) because of poor management. With the assistance of the Dutch Company which replaced Glover as the joint manager, a new pit — the Minami Hiroi Pit to the south of Takashima — was excavated in March 1871 (Meiji 4). Initially, its developmental level was similar to that of the Hokkei Pit.

The Dutch Company, however, attempted to establish a truly modern mine and invited a British mining engineer, F. Potter, for this purpose. After an investigation of the Hokkei Pit, Potter criticized its limited

scale and its dependency upon endogenous mining techniques and submitted a proposal which would greatly modernize the Nanyo Pit then under excavation.

Potter suggested that excavation be done at the Bandō and Ichijō Hasshaku coal seams which were located beneath the Hasshaku coal seam which had been previously excavated. He proposed the excavation of three pits simultaneously to be used separately for the specific purposes of transportation, drainage and ventilation. Each pit was designed for use with machinery in order to maximize the standard of mechanization. He proposed "to set up the Nanyo Coal Pit with the identical acreage of a British coalmine." The cost was estimated to be 120,000 ryō of which 50,000 ryō was for the purchase of machinery. His aim was full-scale modernization with a daily output of 500 tons and an annual output of 180,000 tons.

Although this was a five-year plan, it did not materialize while the joint venture was in operation. The joint venture was dissolved soon after the project started. Based upon data of the Nanyo Pit, this modernization project was started in 1871 (Meiji 4). The account book of the same year reveals that 37,520 Mexican silver dollars (3,138 of which were for the purchase of machinery) were spent as development expenses for the Nanyō Pit.

The government, however, issued the Directions for Mining in March 1872 (Meiji 5) prior to the proclamation of the Japanese Mining Act, and prohibited the participation of any foreign national in the management of mines. Despite the fact that Naomasa Nabeshima applied for a new permit stating that he would be the sole owner, the government did not grant approval. The government instead nationalized the Takashima Coalmine. The Dutch Company was then expelled from management and the debts incurred by it were settled by the government.

Due to such circumstances, the modernization project of the Nanyo Pit collapsed. This being the case, it would not be accurate to state that the Takashima Coalmine was fully modernized from the beginning.

The Takashima Coalmine was nationalized at the end of 1873 (Meiji 6). Government ownership was transferred a year later to Shōjirō Gotō, a businessman with political affiliations. After he carried out full-scale modernization, the mine became capable of producing over 100,000 tons annually. It was subsequently bought by Mitsubishi in 1881 (Meiji 14). It not only became the foundation of coal-mining operations for Mitsubishi, but it later became the foundation of the modern coal-mining industry in Japan together with the state-owned Miike Coalmine.

TABLE 8. Coal Output of the Takashima Coalmine

Year	Output (10,000 tons)	Year	Output (10,000 tons)
1874 (Meiji 7)	6.9	1886 (Meiji 19)	27.0
75 (8)	12.5	87 (20)	30.2
76 (9)	10.1	88 (21)	30.6
77 (10)	9.3	89 (22)	26.5
78 (11)	15.0	90 (23)	23.8
79 (12)	18.7	91 (24)	20.0
80 (13)	23.0	92 (25)	23.0
81 (14)	23.7	93 (26)	23.0
82 (15)	25.4	94 (27)	21.2
83 (16)	23.6	95 (28)	17.7
84 (17)	22.6	96 (29)	17.7
85 (18)	27.0	97 (30)	15.3

Source: Data formulated from the attached table in Meiji Kogyoshi, Mining Section.

(3) The Role of Endogenous Technology and Labour in the Modernization of the Takashima Coalmine

The modernization of the Takashima Coalmine, the first of its kind in Japan, had a great impact upon those engaged in the coal industry, which had always been subject to the problem of drainage. Many came to the Takashima Coalmine to observe a modernized mine, and their accounts in turn influenced more people. Since the Takashima Coalmine was the first modernized coalmine in Japan, it acted as a catalyst for the modernization of the coal-mining industry.

Moreover, necessary technical staff were trained there who provided other coalmines with technical guidance as they in turn modernized. Machine operators, boiler men and skilled miners familiar with various British methods of excavation effectively nurtured such techniques as

the cutting of coal to form pillars and the installation of supportive wood timbers. In this connection, it can be said that the Takashima Coalmine acted as a harbinger for the modernization of the Japanese coal industry.

How did both the endogenous technology and labour change to accommodate modernization at the Takashima Coalmine which played such a historic role? As far as technological aspects are concerned, it can be stated that the endogenous technology directly contributed to modernization and itself gradually came to be modernized.

As mentioned above, the modernization of the Takashima Coalmine was limited to a partial and small-scale effort. In consequence, there are two aspects where the endogenous technology was able to make a positive contribution. The first is related to the fact that it was the endogenous skilled miners who actually carried out the instructions given by such foreigners as Morris (the mining engineer), Otter the installer and operator of machinery, and the foreman Lessep, who taught western methods of coal extraction.

Upon opening a new pit, Morris would have had to depend on the knowledge of endogenous contractors and skilled miners concerning the coal bed, topography and abandoned pits. Furthermore, the actual excavation was also done by endogenous engineers and skilled miners under foreign instruction. A modernized coalmine would not have come about without the cooperation of these endogenous engineers and miners. The Takashima Coalmine, therefore, had a sufficient accumulation of mining technology to make the actualization of a modern coalmine possible.

The second aspect is the fact that, in view of its partial and limited modernization, the major portion of the Takashima Mine which was not modernized was operated entirely with the endogenous technology. The ventilation of the so-called modern mine was managed through the use of abandoned pits. The drainage of seeping water was accomplished through the use of Japanese water wheels. In addition, the endogenous method of excavation must have been applied initially to excavate pits.

The modernization of the Takashima Coalmine materialized, therefore, because of a compromise between modern and endogenous technologies.

It was clear, however, that the endogenous technology had its limitations. In view of the scarcity of large-scale mining operations in Japan, there was inadequate knowledge and experience, and thus the government was obliged to train and nurture modern mining engineers. Moreover, the Takashima Coalmine was able to produce western-trained Japanese engineers and skilled miners under the guidance of foreign engineers.

Let us examine labour in the coal industry. The bearers of the endogenous technology at Takashima were contractors and skilled miners. During the joint venture period, the traditional labour pattern, based upon a system of mining by contract, was adopted. Miners were organized and led by their respective contractors.

In areas where traditional conditions prevailed, miners with conventional skills extracted coal from the coalface, carried out the coal and drained seeping water. However, new occupational categories required for a modernized coal-mining operation also emerged. These included machine operators, boiler men, other mechanized staff members such as coal cart drivers and, most important of all, miners who had acquired western mining techniques. Those who wished to take up such occupations had to be trained by foreign engineers.

Because the Saga clan had as its objective the operation of a modern coalmine solely by Japanese nationals, it had chosen competent personnel to be trained for the new occupations during the joint venture period of seven years. These persons readily acquired new technical skills and formed the nucleus of specialists for the modern coalmines.

The Modernization of the State-Owned Miike Coalmine From the Late 1870s to the 1880s

(1) The Nationalization of the Miike Coalmine

The Miike Coalmine was the second to be modernized in the Japanese coal-mining industry. Together with the Takashima Coalmine, it was one of the two major endogenous coalmines. After the Meiji restoration, the ownership of the coalmines at Mount Inari and Mount Ikee, which had belonged to the defunct Miike clan, was transferred by the new government in 1871 (Meiji 4) to Yasunari Iorihara and other former clan retainers. This was to be for a limited term of five years. On the other hand, because Mount Hirano, which formerly belonged to the Yanagawa clan, was privately owned by the Ono family, its management remained unchanged. Due to the issuance by the government of the Directions for Mining in 1872 (Meiji 5) however, the Ono family was forced to apply for a new permit in order to continue the mining operation at Mount Hirano. This application, however, was rejected by the government for unknown reasons.

In addition, a fierce dispute surfaced in January 1872 (Meiji 5) between the Ono family and the new managers such as Iorihara over the boundaries of their respective mining districts. This feud, which had developed during the latter half of the 1850s, was so deep-rooted and fierce that the government authorities found it to be one they could not mitigate. Consequently, although the policy of general nationalization of coalmines did not yet exist, both mines were nationalized in 1873 (Meiji 6) to put an end to the feud.

Even though the administration initially maintained conventional operations, a modernization project was introduced from about 1875 (Meiji 8). When a movement to transfer the Miike Coalmine to private ownership arose, Hidetomo Kobayashi and other mining bureaucrats at the Miike Coalmine insisted upon the continuation of state ownership. Coupled with the powerful backing of the Mitsui Trading Company which was in sole charge of coal sales, the government set up a development project in order to begin modernization. The government employed foreign engineers to conduct a survey of the mine for this purpose.

However, conflicting opinions pertaining to modernization methods existed among the managing authorities. The first step toward modernization was taken in October 1876 (Meiji 9) during a process of reconciliation. One group insisted that full-scale modernization be carried out, and they proposed to modernize the Mitsuyama Pit with the aid of Godfrey and Moses at an estimated development cost of 700,000 yen. Another group insisted that partial modernization be achieved through improvement of the conventional mine. This proposal was put forward by Potter who had drafted the modernization plan for the Takashima Coalmine. It also received the support of his followers, such as Kobayashi and the leaders of the Miike Coalmine. The estimated cost for this plan was 100,000 yen. The latter plan proposed by Potter and others gained the support of the new government which was then facing financial difficulties. The modernization project was thus started in 1876 (Meiji 9). It was the government which promoted modernization of the pit until ownership was transferred to the Mitsui Trading Company.

(2) The Modernization Process of the State-Owned Miike Coalmine

The modernization process of the Miike Coalmine can be divided into two stages. The first stage covered the latter half of the 1870s when a new shaft was excavated together with the revival of a number of abandoned pits. This was based upon the Potter plan which sought a compromise between the endogenous and modern coal-mining technologies. The second stage occupied the 1880s when the aim was full-scale modernization.

The goal in the first stage was to modernize the Ōura Pit, which entailed three projects. The first project was to open the Mitsuyama Pit which was started in 1876 (Meiji 9) and completed in December of the following year. This was opened to serve as a ventilation pit for the old Ōura and Umetani pits as well as for the Ōura Inclined Shaft which was to be opened later. These old flooded pits were revived, first of all, by draining flooded water with the use of a steam-driven pump which was installed at the entrance. The Mitsuyama Pit measured

3.9 metres in length, 3 metres in width and 49 metres in depth (similar in size to the Hokkei Pit at the Takashima Coalmine).

The second project was to excavate a new inclined shaft at Ōura as the central area for coal extraction. Moreover, its excavated position was such that a new shaft would be connected by an adit to an abandoned pit so as to revive the latter. The excavation of the new inclined shaft began in December 1876 (Meiji 9). It paralleled the former Ōura Inclined Shaft which had taken three years to excavate in the latter half of the 1850s. The extraction of coal in the new shaft began in August of the following year. The shaft measured 170 metres in length and then an adit measuring 225 metres long was excavated after the extraction of coal was begun. The height of the shaft was 1.8 metres and its width was 3 metres. A new 720-metre adit connecting the old shaft to the new one was further excavated. The adit, measuring 1.8 metres in height and 3.6 metres in width, was completed in March 1878 (Meiji 11).

As far as mechanization was concerned, a 48-horsepower hoisting machine and three boilers were installed at the new Ōura Inclined Shaft. The cost of machinery was 6,200 yen. Although a double track was installed, the extent to which transport and drainage were mechanized is unclear but appears to have been almost negligible.

The third project was to revive the old flooded Ōura Pit. Drainage work was started in 1876 (Meiji 9) with the use of 80 layers of water wheels which were installed for this purpose. After completing the drainage, which took four months, a canal pit measuring 360 metres was newly excavated to complete the drainage system.

The Mitsuyama Pit, which was excavated as a ventilation pit, did not have mechanized ventilation. A furnace was intalled in the pit and the air was circulated by the rising current caused by the heat of the furnace.

It can thus be seen that the modernization of the Ōura Pit was very

similar to that of the Hokkei Pit in the Takashima Coalmine. However, because the Miike Coalmine itself had been a much larger mine, the new Ōura Pit also came to be large due to the amalgamation of both the old and new shafts. While the annual output of coal from the old Ōura Pit was less than 10,000 tons, this increased to 38,000 tons in 1878 (Meiji 11) after modernization. It reached 92,000 tons in 1879 (Meiji 12) and 114,000 tons in 1880 (Meiji 13). The output, however, decreased from 1882 (Meiji 16) onwards due to the fact that its modernization had been compromised by reliance upon the old mine.

TABLE 9. Coal Output of the Major Pits at the State-Owned Miike Coalmine

Year	Ōura Pit		Umetani Pit		Nanaura Pit		Subtotal of Other Pits		Total for Miike	
	10,000 tons	%	10,000 tons	%	10,000 tons	%	10,000 tons	%	10,000 tons	%
1873 (Meiji 6)	0.4	13.3	0.8	27.0	-	-	1.8	59.7	3.0	100
74 (7)	1.0	15.1	1.6	24.4	-	-	4.0	60.5	6.6	100
75 (8)	0.7	21.8	1.2	39.1	-	-	1.3	39.1	3.2	100
76 (9)	0.8	16.1	1.0	19.7	-	-	3.2	64.2	5.0	100
77 (10)	-	-	-	-	-	-	-	-	5.8	100
78 (11)	3.8	39.4	1.5	15.6	-	-	4.5	45.0	9.8	100
79 (12)	9.2	64.8	1.8	12.9	-	-	33.2	22.3	14.2	100
80 (13)	11.4	65.8	1.3	7.6	-	-	4.7	26.6	17.4	100
81 (14)	11.0	67.7	1.5	9.5	-	-	3.8	22.8	16.3	100
82 (15)	10.9	73.6	1.1	8.0	0.9	6.6	2.0	19.0	14.9	100
83 (16)	2.2	13.3	0.4	2.8	12.5	74.7	1.6	9.2	16.7	100
84 (17)	3.3	13.3	0.6	2.5	19.3	76.9	1.9	7.3	25.1	100
85 (18)	4.1	22.8	0.1	0.5	13.6	74.6	2.1	2.1	18.3	100
86 (19)	4.0	14.0	0.2	0.8	24.4	84.6	0.6	0.6	28.8	100
87 (20)	7.2	22.2	0.3	1.1	24.4	74.6	2.1	2.1	32.7	100

Source: Data formulated from Ōmuta-shi Shi, vol. II, pp. 423-425.

Modernization in the second stage was aimed at the opening of a modern coalmine at the Nanaura Pit. The excavation of the first pit started in July 1879 (Meiji 12) and coal was extracted from June 1882 (Meiji 15). The entrance of the pit was circular, with a diameter of 4.2 metres and a depth of 71 metres, and was, thus, slightly larger than that of the Takashima Coalmine. Excavation was extremely difficult due to the excessive water seepage and many boilers and pumps had to be installed. When the extraction of coal was finally made possible, the operation started with the use of a hoisting machine. Distinct aspects of modernization were as follows: (1) Because of the large-scale method of extraction, the area of extraction was large enough to

sort out coal at the coalface. (2) A track as long as 800 metres was installed in the adit. Drainage was partially accomplished by water wheels. Although it is unknown whether or not the track was mechanized, it is assumed that it gradually did come to be mechanized.

The excavation of the second pit was started in May 1882 (Meiji 15) and coal extraction began in June of the following year. Because this pit was excavated to serve as a ventilation pit, a fan and a boiler were installed. In this way, the first mechanized ventilation system came into being, and further expansion of the scale of coal extraction was made possible.

A grader was installed outside the first pit. In March 1884 (Meiji 17), an old adit which was located about three kilometres away from the first pit was revived; this was named the third adit. This adit adjoined the pit so that it could serve as an emergency passage for miners. The Nanaura Pit, unlike the Ōura Pit, consisted of newly excavated pits except for the third adit. The level of mechanization was higher, as boilers had been installed in the pits. It appears that the adit was also somewhat mechanized.

The output of the Nanaura Pit when production started in 1882 (Meiji 15) was 9,000 tons. This suddenly increased to 120,000 tons in the following year, and to 240,000 tons in 1886 (Meiji 19). It thus became a full-scale mine. The Miike Coalmine as a whole moved toward full-scale modernization following the model of the Nanaura Pit. Consequently, a sharp increase in labour productivity was also achieved.

(3) Problems Pertaining to the Modernization of the Miike Coalmine

Even though the modernization of the Miike Coalmine was promoted by the government some ten years after that of the Takashima Coalmine, it shares similar historical significance as a forerunner of modern Japanese coal mining. In other words, the desire for modernization on the part of the endogenous coal industry was stimulated by the model

TABLE 10. Coal Output Per Miner at the Miike Coalmine

Year	Total Number of Miners	Output per Miner (tons)
1875 (Meiji 8)	1,560	21.0
76 (9)	1,016	-
77 (10)	807	67.6
78 (11)	1,141	68.5
79 (12)	1,659	72.4
80 (13)	1,998	59.1
81 (14)	1,992	84.7
82 (15)	2,028	77.1
83 (16)	1,595	93.1
84 (17)	2,430	86.3
85 (18)	2,685	92.4
86 (19)	2,717	102.2
87 (20)	3,049	104.2
88 (21)	3,103	118.6

Source: Data from "Kan-ei Miike Tankō to Mitsui Bussan" by Yutaka Kasuga in Mitsui Bunko Ronsō, no. 10, p. 278 (excluding the data on the output of coal).

set by the state-owned Miike Coalmine. It also nurtured the necessary personnel for future modern coalmines and thus aided in the foundation of the modern coal-mining industry in Japan.

However, with regard to the adjustment of technology and labour in the case of the Miike modernization, there were several distinct differences from the Takashima Coalmine. Let us first examine the technological aspects. Guidelines for the modernization of the Miike Coalmine were first set by a number of foreign engineers with whom the endogenous engineers cooperated. However, because Potter returned home due to illness, modernization in the second stage was conducted primarily by Japanese mining engineers who had graduated from the College of Engineering. Government policy thus became fully implemented in the case of the Miike Coalmine. Moreover, many of the small mining machines used for modernization were no longer imported, but manufactured by state-owned factories. Government policy to set up state-owned modern factories was not simply aimed at the production of munitions, but was extended to the production of mining machinery. This aspect has often been ignored. The state-owned Miike Coalmine, in consequence, came to be operated independently by Japanese.

Modern mining technology by Japanese, however, was limited due to the

fact that the nation's factories were only capable of producing small mining machines. Furthermore, the modern coalmines themselves were not of a very large scale. In this connection, the Katsutachi Pit was excavated in 1885 (Meiji 18) under the leadership of Takuma Dan, an American-trained engineer. The pit measured 5.4 metres in length, 3.6 metres in width and 119 metres in depth, which made this pit much larger than average.

Although the goal of this pit was the large-scale extraction of coal, excavation was hindered by excessive water seepage. Excavation had to abandoned as the amount of water to be drained was completely beyond the capacity of the Japanese-made pumps. The development of full-scale modern coalmines came about after the Miike ownership was transferred to Mitsui, as it then became possible to produce large-scale mining machines at the Miike Factory.

What is noteworthy regarding labour during the modernization of the Miike Coalmine is that, in addition to giving miners on-the-job training for modern occupations, many workers with experience in modern operations were transferred from the Takashima Coalmine. This made the modernization process at the Miike Coalmine easier.

Unlike the Takashima Coalmine, the Miike Coalmine did not adopt the contractor system (and the bunkhouse system which is a variation). The Mitsui Trading Company suggested that the bunkhouse system be applied when they faced a shortage of labour in the process of modernization. This suggestion, however, was ignored and, instead, the decision was made to use cheap prison labour. Although such labour may have been cheap, productivity was also low. Thus it is questionable how efficient prison labour was.

Despite the fact that there were several negative aspects, the modernized state-owned Miike Coalmine became the largest modern coalmine during the first half of the Meiji period. After its transfer to Mitsui, it not only became the basis of Mitsui's coalmine operations, but also played an immeasurable role as the nucleus for

TABLE 11. Coal Output in Percentage of the Two Major Coalmines

Year	Takashima Coalmine (percentage)	Miike Coalmine (percentage)	Nationwide share of the two (percentage)
1874 (Meiji 7)	33.1	31.2	64.3
75 (8)	22.0	5.6	27.6
76 (9)	18.5	18.7	37.2
77 (10)	18.8	10.9	29.7
78 (11)	22.0	11.4	33.4
79 (12)	21.8	14.0	35.8
80 (13)	22.6	13.3	35.9
81 (14)	25.6	18.1	43.7
82 (15)	27.3	16.7	44.0
83 (16)	23.5	15.7	39.2
84 (17)	19.8	18.3	38.1
85 (18)	20.8	19.1	39.9
86 (19)	19.6	20.1	39.7
87 (20)	17.2	18.1	35.3
88 (21)	15.1	18.1	33.2
89 (22)	11.0	19.3	30.3
90 (23)	9.1	18.6	27.7
91 (24)	6.2	18.0	24.2
92 (25)	7.2	15.0	22.2

Source: Data formulated from the attached table in Meiji Kōgyōshi, Mining Section.

the formation of the Mitsui zaibatsu.

Two of Japan's major endogenous coalmines, therefore, acted as the forerunners of the nation's modern coal-mining industry.

IV. THE MODERNIZATION PROCESS OF COAL MINING IN THE CHIKUHŌ REGION

The Development of the Endogenous Coal Industry Since the Meiji Restoration

The formation and expansion of the modern coal market since the Meiji Restoration brought about the modernization of the two major endogenous coalmines and, in addition, the development of the endogenous coal industry in the Hizen and Chikuhō regions. The development of the endogenous coal industry in northern Kyushu since the Meiji Restoration derived from the enterprise of the general public which was, for the first time, allowed to manage private coalmines.

The number of coalmines in Chikuzen grew from 177 to 315 in 1877 (Meiji 10) and to 533 in 1882 (Meiji 15), with even more active development occurring in Hizen than in Chikuzen.

TABLE 12. Number of Coalmines in Northern Kyūshū

Year	Chikuzen	Buzen	Hizen
1873 (Meiji 6)	177	-	308
77 (10)	315	-	550
82 (15)	533	127	922

Source: Data for 1873 are from Fukuoka-ken Shi, vol. II, book 2, pp. 386-387 and from Meiji Zenki Hizen Sekitan Sangyō Shiryō Shū, bibliographical notes, p. 4. The other data are from Nippon Sekitan Sangyō Bunseki by Mikio Sumiya, pp. 142-144. The number of mines in Hizen for 1877 is based upon the number for 1878. Data for 1882 denote the number of mining districts.

However, the endogenous coal-mining industry was of a small scale based mainly upon the endogenous technology. Medium-sized coalmines with more than 50 miners were rare. For example, 45 per cent of the coalmines in Ogi County, Hizen, in 1881 (Meiji 14) had less than ten

miners. Only 14.4 per cent of the mines were operated by more than 50 miners. It is presumed that conditions were about the same in Chikuhō.

TABLE 13. Number of Coalmines According to Size in Ogi County, Hizen

No. of miners	No. of mines	Percentage
Less than 5	11	42.8
6- 10	7	
11- 15	5	21.4
16- 20	4	
21- 30	5	21.4
31- 50	4	
51- 70	2	
71-100	2	14.4
101-150	1	
More than 151	1	
	42	100.0

Source: Data formulated from Kōzan Enkaku Shirabe.

The annual output of coal in Chikuhō which was approximately 75,000 tons in 1877 (Meiji 10) grew to 198,000 tons in 1882 (Meiji 15) and soared to 410,000 tons in 1887 (Meiji 20). The sharp increase in the 1880s was due to the rapid establishment of modernized coalmines.

TABLE 14. Transition of Coal Output in the Chikuhō Region

Year	Four Countries in Chikuhō (10,000 tons)	Year	Four Countries in Chikuhō (10,000 tons)
1877 (Meiji 10)	7.5	1892 (Meiji 25)	124.4
78 (11)	-	93 (26)	123.4
79 (12)	15.9	94 (27)	171.0
80 (13)	18.1	95 (28)	213.6
81 (14)	18.2	96 (29)	234.2
82 (15)	19.8	97 (30)	272.6
83 (16)	23.0	98 (31)	363.4
84 (17)	30.2	99 (32)	346.0
85 (18)	35.3	1900 (33)	401.7
86 (19)	30.9	01 (34)	485.5
87 (20)	41.3	02 (35)	493.0
88 (21)	55.6	03 (36)	505.6
89 (22)	67.5	04 (37)	538.7
90 (23)	79.4	05 (38)	580.4
91 (24)	92.8	06 (39)	644.5

Source: Data formulated from Nippon Sekitan Sangyō Bunseki by Mikio Sumiya and other sources, excluding figures for the Miike Coalmine.

The development of the endogenous coal industry in northern Kyushu, e.g. in Chikuhō, contributed not only to the advancement of the endogenous coal-mining technology but also to an accumulation of experienced and skilled coalminers. Thus, the necessary conditions

for the modernization of coalmines in this region were met. Furthermore, the backwardness of conventional technology was revealed in the intermim, and modernization in Chikuho became an obvious necessity.

The Modernization of the Endogenous Coal-Mining Industry

(1) Initial Attempts at Modernization in the Early Meiji Period

The modernization of other coalmines was not as successful as that of the Takashima and Miike mines. Various attempts at modernization made by those mines shall be examined in this section in order to illustrate their problems.

After the modernization of the Takashima Coalmine, an attempt was made to modernize the Hokkaido mines at the end of the Tokugawa era. Due to the conclusion of the Treaty of Kanagawa in 1854 (Ansei 1), the Tokugawa government was made responsible for the supply of coal to American ships at Hakodate. The Tokugawa government subsequently opened the Shiranuka Coalmine using conventional technology in 1856 (Ansei 3), which proved unsuccessful. A coal survey was carried out by an American mining engineer at Kayanuma in 1862 (Bunkyū 2). In 1864 (Genji 1), the Kayanuma Coalmine was excavated but with poor results. An attempt at the modernization of the Kayanuma mine was made in 1866 (Keiō 2) by a British engineer who was employed for this purpose. In spite of this attempt, the mine, in reality, was not any larger than the existing endogenous coalmines and furthermore had only a conventional technological standard with not much mechanization. Mechanization of the mine involved no more than the installation of tracks inside and outside the mine and even these were operated manually. It was not until the development of the state-owned Horonai Coalmine that modernization of coal mining in Hokkaido was effected.

There are various reasons for the lack of success in modernization in Hokkaido. First, because Hokkaido was an underdeveloped area, an external economy necessary for the existence of a coal industry was

lacking. It required a tremendous sum of money to develop facilities other than the coalmine itself, such as a coal transportation system. Secondly, there was no endogenous coal industry in either Hokkaido or Tohoku. In consequence, it was difficult enough to operate a conventional coalmine, let alone a modern one. The successful modernization of the Takashima and Miike coalmines was accomplished because they were based upon a solid endogenous coal-mining industry, a fact that becomes more obvious when contrasted to the unsuccessful attempts made in Hokkaido at the end of the Tokugawa period and the early Meiji period.

The next attempt, following Hokkaido, was made in the Ube region of the Chōshū clan. The Coal Bureau of the Chōshū clan, which had been troubled by drainage problems, invited an American in 1868 (Meiji 1). Although a drainage pump was introduced, it proved unsuccessful. Then in 1870 (Meiji 3), three coalminers were sent to the Takashima Coalmine for two months to learn modern coal-mining methods.

The Chōshū authorities also invited Morris to conduct test boring and to install a steam-powered pump but these efforts were unsuccessful. It was, therefore, not until the 1880s that modernization in Ube was achieved. The reason early modernization in Ube could not materialize is presumably that Ube coal, which was inferior in quality, could not compete on the market especially when it was expensive as a result of mechanization. Moreover, due to the extraction of coal from deep beds, there was a severe water seepage problem which could very well have limited a small pump's effect.

Although it is recorded that Morris attempted modernization in Hizen in the early Meiji period, the details remain unknown. However, there is a record which states that the Kishiyama Coalmine in Higashi Matsuura County, Hizen, which had been a promising mine since the latter half of the 1850s, began mechanized drainage using a steam-driven pump from about 1873 (Meiji 6). This modernization, however, involved no more than the addition of a steam-driven pump to a conventional mine.

The initial attempt at modernization in Chikuho was made in 1875 (Meiji 8) by Iwajiro Hayakawa, a wealthy farmer from Tagawa County who cooperated with Itsuta Katayama, a former mechanic of the Nagasaki Shipyard. Although they tried to introduce a steam-driven pump and a hoisting machine to the Itoda Coalmine, the attempt was unsuccessful.

Another attempt was made by Tasuke Kaijima, who had cooperated with the mechanization project of the Itoda Coalmine. Although he purchased steam-driven machinery in Nagasaki and began a test operation, this resulted in failure. An attempt to introduce a drainage pump to the Katsuki Coalmine, Onga Country, was made by Yoshikata Hoashi in 1880 (Meiji 13), which was also unsuccessful.

All the initial attempts to mechanize the coalmines in Chikuhō were, thus, unsuccessful, for various reasons. First, there were no foreign engineers to give guidance, and local knowledge of coal-mining machinery was too limited to be applied to the operation of the machines which had been purchased. Second, the managers lacked sufficient capital. Because they could not afford coal-mining machinery, they purchased small second-hand marine boilers and marine pumps which were of no use in coalmines. The modernization of the coalmines in Chikuhō started in the 1880s.

(2) The Modernization Process of the Endogenous Coal-mining Industry

During the period when Japanese capitalism was being established, the modernization of the coal industry in Chikuho was carried out roughly in two steps. The first stage took place from about 1882 to about 1892. This was the stage when small-scale modernization was attempted primarily by the endogenous coalminers who had neither capital nor the guidance of foreign engineers. The second stage started at the end of the 1880s when fairly large-scale modernization was introduced into the coalmines by big capital mainly affiliated with the zaibatsu.

Let us examine the modernization process in the first stage. As already pointed out, the endogenous coal industry which developed from

the early Meiji years in Chikuhō was limited to small-scale mines. In 1883 (Meiji 16), however, managers of these small coalmines were succeeded by more powerful ones due to the revision of the Japanese Coal Mining Act which stipulated a minimum lease area of over 10,000 tsubo instead of the previous 500 tsubo. In 1883 (Meiji 16), only 31 managers (5.2 per cent of the applicants) had lease areas of over 10,000 tsubo in Chikuhō. This figure, however, grew to 66 (14 per cent) three years later. The initial period of coalmine modernization in Chikuhō was carried out, therefore, primarily by powerful endogenous managers.

TABLE 15. Distribution of Leased Areas by Size in Chikuzen

(Unit: No. of Lessees)

	1883 (Meiji 16)		1886 (Meiji 19)	
Less than 500 tsubo	152	(25.7)	114	(24.4)
1,000	198	(33.5)	126	(27.0)
2,000	139	(23.5)	115	(24.6)
3,000	40	(6.7)	22	(4.7)
5,000	30	(5.0)	23	(4.9)
10,000	15	(2.5)	10	(2.1)
20,000	7	( )	33	( )
30,000	2	(2.7)	9	(1.9)
30,001	7	( )	14	(3.0)
	590	(100.0)	466	(100.0)

Source: Data formulated from Asō Hyakunenshi, pp. 10-11.

The first successful modernization of a coalmine in Chikuhō (which made this the third such instance in Japan), was accomplished at the Shakanoo Coalmine by Tokusaburō Sugiyama. He was a retainer of the Chōshū clan and had been sent to Nagasaki at the age of 18. He had been chosen to study mechanical technology at the Nagasaki Iron Mill in 1856 (Ansei 3). Based upon the connection he had made with Hirobumi Ito after the Meiji Restoration, he was able to obtain a lease to manage the Yokohama Iron Mill. He returned the lease, however, when the operation proved to be unsuccessful. He then decided to take up management of a coalmine using the compensation he had received. In this manner, he began management of a modern coalmine in 1880 (Meiji 13) with a lease area of 70,000 tsubo at the Shakanoo Coalmine.

A pit measuring 45 metres in depth was excavated. A horizontal boiler

of Cornish design, two new eight inch special pumps and a hoisting machine were installed. Although details of the modernization of the Shakanoo Coalmine are unclear, the effort was probably no different from that of the Hokkei Pit at the Takashima Coalmine. In this connection, the output of coal at the Shakanoo Coalmine in 1890 (Meiji 23) was 50,000 tons. Probably due to the fact that Sugiyama was well versed in mechanics, the mechanization effort was successful. Foreign engineers were not mobilized for the excavation of this mine. He, therefore, had to depend entirely upon foremen from among the endogenous coalminers as he knew nothing about coalmine management or coal-mining technology.

Consequently, the first mechanized coalmine in the Chikuhō region, although small, was opened and managed in a collaborative effort between an ex-warrior who came with capital and mechanical knowledge from another clan and the endogenous coalminers who possessed coal-mining technology.

The establishment of the modern Shakanoo mine by Sugiyama had a great impact upon the endogenous coal industry in Chikuhō. Coalmines operating at about the same level as the Shakanoo Coalmine began to be established in rapid succession. One who followed the example set by Sugiyama was Yoshikata Hoashi who came from Akō in Hyōgo. He became interested in the coal industry when he came to Chikuhō at the time of the Satsuma Rebellion. From that time on, he engaged in the management of a coalmine. Despite an initial failure in mechanizing the mine, he continued to study technical books on his own. He then opened the Shinnyu Coalmine in Kurate County in 1883 (Meiji 16), and made another attempt at modernization. A pit measuring 39 metres in depth was excavated, and equipped with two boilers, a 30-horsepower hoisting machine and a drainage pump.

Since he was not well versed in coalmine management and mining technology, he tried to modernize the mine by mobilizing foremen; he also invited mechanics from the advanced coalmines.

The establishment of modern mines by Sugiyama and Hoashi greatly influenced other endogenous mine managers. Small-scale modern mines were subsequently established in succession.

Thus it is found that in 1885 (Meiji 18), the Hontō Coalmine under Takasuke Konomi and the Mineji Coalmine under Masakazu Kurachi and Jirosaku Kurauchi were excavated and equipped with machinery. The same was done in 1886 (Meiji 19) at the Namazuta and Tadakuma coalmines by Takichi Asō, at the Ōnoura Mine by Tasuke Kaijima and at the Uruuno Mine by Japan Coalmine. Moreover, the Daijō Mine was excavated and equipped with machinery by Keiichirō Yasukawa in 1887 (Meiji 20).

Although the level of modernization reached by the mines is not clear, based upon their coal output, it is understood that they were of a small scale. Mechanization was still limited to drainage and the transport of coal from the bottom of a pit to its entrance. There was hardly any technical guidance given by either foreign engineers or modern Japanese mining engineers. Thus the extraction methods were totally dependent upon conventional technology. Foremen and skilled miners, however, who had become well trained in western coal-mining methods at modern mines gradually began to spread this knowledge elsewhere.

In 1880 (Meiji 23), there were four coalmines with an output of about 50,000 tons and five mines with a capacity of 20,000 to 30,000 tons. The proportion of mines which had an output of over 20,000 tons in the Chikuhō region in the same year was 49.2 per cent. This grew to 78.6 per cent in 1882 (Meiji 25), thus bringing about a predominance of modern coalmines.

The Modernization of the Coal Industry by Big Capital

The second stage of modernization of the coal industry in the Chikuhō region took place over a period of about 20 years starting from the

TABLE 16. Coal Output of the Major Mines in Chikuhō 1880 (Meiji 23)

Name of Mine	Owner	Output (tons)	Remarks
Shinte Honto	Takasuke Konomi	59,711	
Daijō	Keiichirō Yasukawa and three others	50,965	
Shakanoo	Matsutarō Sugiyama and one other	50,728	
Ōtsuji	Seiichi Miyata	48,346	The former Katsuki Pit owned by Hoashi
Shinnyū	Yanosuke Iwasaki	38,129	Used to be called the Kurumi Pit
Namazuta	Yanosuke Iwasaki	34,532	
Ōnoura	Tarō Kaijima	32,677	
Tadakuma	Takichi Asō	25,093	
Sugamuta	Shinzaburō Katsuki	22,646	Cooperated with Tasuke Kaijima
Aida	Hisomu Matsumoto	18,879	The later Takao Pit
Itoda	Uzaemon Isono and two others	18,393	The later Hōkoku Mine
Kasamatsu	Takichi Asō	16,590	
Mineji	Shigetoshi Kurachi	14,687	
Igisu	Denroku Itō	14,286	
Kama	Takichi Asō and Banroku Arimatsu	13,094	
Shōji	Yotsu Chikamatsu and four others	13,690	
Ikumasa	Kaneo Iwami and one other	12,290	
Hiyakifuruta	Masao Konomi	11,645	

Source: Data from a survey by Chikuhō Sekitan Kōgyō Kumiai and Asō Hyakunenshi, p. 194.

TABLE 17. Percentage of Mines With an Output of More Than 20,000 Tons in Chikuhō

Year	No. of Mines	Percentage
1890 (Meiji 23)	9	49.2
1891 (Meiji 24)	14	71.3
1892 (Meiji 25)	15	78.6

Source: Data formulated from Nippon Sekitan Sangyō Bunseki by Mikio Sumiya, pp. 224 and 240 and from Asō Hyakunenshi, p. 194.

end of the 1880s. It was during this stage that modern mines were established by the penetration of zaibatsu capital into this coal region as well as by the emergence of powerful endogenous mine managers.

The modernization process by big capital can be divided into two stages which are demarcated by the Sino-Japanese War. The first phase of modernization by big capital began in the late 1880s with the Tagawa Coal-Mining Company, a joint operation using central

capital and a small amount of local capital.

Such Tokyo capitalists as Eiichi Shibusawa, Ryōsuke Fukushima and Seiichi Taneda, and an Osaka capitalist by the name of Denzaburō Fujita, wanted to venture into mining in the Chikuhō region. They established, together with influential managers in Fukuoka Prefecture, the Tagawa Coal-Mining Company in 1889 (Meiji 22). The company was founded with a capital of 650,000 yen and obtained in December 1889 (Meiji 22) a large mining area of 2,510,000 tsubo in Tagawa County.

First of all, an inclined shaft measuring 2.1 metres in height, 4.2 metres in width and 126 metres in length and a pit measuring 4.2 metres in length, 2.4 metres in width and 48 metres in depth were excavated. Seihou Asō, who was a member of the second graduating class of the College of Engineering of the Department of Mining was appointed as the chief engineer of this company. He was thus in charge of the excavation of this mine. Due to excessive water seepage and obstruction caused by the rock bed, the excavation project did not progress as originally planned. The executives were confronted with a difficult situation as the excavation budget of 480,000 yen was consumed prior to the completion of the project.

The executives, such as Asō, felt responsible for this state of affairs and resigned. Osamu Ishida, from the fourth graduating class of the College of Engineering, the Department of Mining, who was a staff member of the Fujita Company, was appointed to complete the task. Tsunokei Tani, an influential endogenous mining engineer at Tagawa, was appointed as foreman. They began excavation at a shallower coal seam than was originally planned and started operation of a small-scale modern coalmine.

In 1891 (Meiji 24), this mine produced 23,800 tons. This was increased to approximately 60,000 tons the following year but its scale as a modern mine was thus rather small.

Mitsubishi, which had purchased the Takashima Coalmine in 1881 (Meiji

TABLE 18. Coal Output of Mitsubishi in Chikuhō

Year	Output (10,000 tons)		Year	Output (10,000 tons)	
	Namazuta Shaft	Shinnyu Shaft		Namazuta Shaft	Shinnyu Shaft
1889 (Meiji 22)	0.8	-	1901 (Meiji 34)	20.7	34.0
90 (23)	4.0	4.2	02 (35)	19.9	34.6
91 (24)	8.2	6.0	03 (36)	21.5	40.0
92 (25)	11.5	12.9	04 (37)	22.4	44.0
93 (26)	12.2	14.0	05 (38)	22.2	42.7
94 (27)	11.7	12.6	06 (39)	20.6	37.5
95 (28)	16.4	15.8	07 (40)	24.7	44.3
96 (29)	17.7	18.7	08 (41)	27.6	43.3
97 (30)	18.0	25.6	09 (42)	27.4	39.9
98 (31)	18.1	26.4	10 (43)	33.5	42.4
99 (32)	19.4	28.7	11 (44)	38.9	39.8
1900 (33)	18.7	28.5			

Source: Data from Mitsubishi Kōgyō Shashi.

14), had wide experience in the management of modern mining. Mitsubishi made advances into Chikuhō prior to Mitsui because Mitsubishi had lost a bid to Mitsui on the purchase of the Miike Mine. Therefore, Mitsubishi bought up both the Namazuta and the Shinnyu Mines in 1889 (Meiji 22). These mines were gradually modernized and Mitsubishi ventured into the management of large-scale coalmines.

The Namazuta was a small modern mine opened by Takichi Asō who was an endogenous coal-mining manager. As soon as this mine was purchased, Mitsubishi transferred engineers and miners from its Takashima Mine in order to bring about full-scale modernization. The first measure taken was to improve the machines in the old pit and further mechanization was accomplished by the installation of an endless rope outside the pit. In 1891 (Meiji 24), long-wall extraction, an expanded coal-extraction method, was introduced. As a result of these improvements, coal production increased to 87,000 tons and this became one of the biggest mines in the Chikuhō region. Two new pits were excavated in 1893 (Meiji 26). These pits were furnished with machines for drainage, coal transportation and ventilation. The Namazuta thus became the largest modernized coalmine in the region. With an output of 115,000 tons in 1892 (Meiji 25), which grew to 162,000 tons two years later, it became the largest and most modernized model coalmine in the Chikuhō region in the 1890s. The scale of mechanization was

radically different from that of the small modern mines.

TABLE 19. The Conditions of Mechanization at the Namazuta Mine (1897 - Meiji 30)

		First Pit	Second Pit	Third Pit
Boiler	two furnaces 7-shaku in diameter	1 unit	2 units	1 unit
	two furnaces 6-shaku in diameter	8	-	3
	one furnace 5-shaku in diameter	2	-	-
Pump	18 inches	20	6	4
	12 inches	3	2	4
	10 inches	2	-	-
	8 inches	-	-	2
	6 inches	-	-	4
Hoist	18-inch double cylinder	1	-	1
	13-inch double cylinder	-	1	-
Fan	Gival Model 14-inch single cylinder	1	-	-
Grader	8-inch single cylinder	1	-	-

Source: Data formulated from Chikuhō Tankōshi by Mototarō Takanoe, pp. 443-446.

The Shinnyu Mine was also modernized to the same degree. Noteworthy regarding the modernization of the coal industry in the Chikuhō region was the construction of railways for the transportation of coal. In spite of the development of the endogenous coal industry and the formation of modernized mines in the Chikuhō region, the transportation of coal was dependent upon conventional riverboat transport along the Onga River. Because of the limited quantity which could be transported by riverboat, riverboat and commission agents used this factor to raise transportation costs. Since this, in turn, caused the cost of coal to soar, the mine managers found themselves in a difficult position.

In order to overcome this predicament, the managers attempted the construction of railways. Railway construction was started in June 1888 (Meiji 21) by interested parties from the five counties in Chikuhō. They established the Chikuhō Industrial Railway Company (Chikuhō Kogyo Tetsudo Kaisha) with a capital of 750,000 yen and commenced construction. Due to insufficient local capital, however, it became necessary to rely upon central capital. Mitsubishi, which in 1890 (Meiji 23) had already become involved in modern mine management in this region, participated in the construction of a railway in order to modernize

the transportation of coal. It eventually gained full control of the operation. Mitsubishi's involvement made it possible to complete the construction of a line between Wakamatsu and Nōgata in 1891 (Meiji 24). The line was then extended to Kaho and Tagawa counties in 1893 (Meiji 26). Furthermore, the Bushu Railway (Bushū Tetsudo) was founded in 1894 (Meiji 27), and established a line in Tagawa County two years later. A solution to the problem of transportation in Chikuhō was thus found.

TABLE 20. The Stage of Modernization of Chikuhō Coal Transport

Year	Railway (%)	Waterway (%)
1891 (Meiji 24)	3.4	96.6
92 (25)	16.2	83.8
93 (26)	33.0	67.0
94 (27)	49.0	51.0
95 (28)	57.0	43.0
96 (29)	64.1	35.9
99 (32)	69.1	30.9
1903 (36)	82.2	17.8

Source: State formulated from Nippon Sekitan Sangyō Bunseki by Mikio Sumiya, pp. 227 and 353.

The second stage of modernization of the coal industry by big capital corresponds to the rapid development of Japanese capitalism after the Sino-Japanese War.

Following the example of Mitsubishi, others such as Sumitomo, Furukawa and Mitsui ventured into the Chikuhō region. Sumitomo, which already managed the Besshi Copper Mine, bought up the Tadakuma Coalmine from Asō in 1894 (Meiji 27). Since its aim was the management of a modern coalmine, it excavated two new pits in 1896 (Meiji 29) and 1900 (Meiji 33), respectively. Furukawa, which managed the Ashio Copper Mine, bought up and modernized the Shiogashira Coalmine in 1896 (Meiji 29). In the same year, it purchased the Shakanoo Mine from Sugiyama.

Mitsui's advance into Chikuhō lagged behind that of the others because it had had to spend the tremendous sum of 4,500,000 yen when it purchased the Miike Mine. In 1896 (Meiji 29), however, it bought up the Yamano Mine in Kaho County and, in 1900 (Meiji 33), the Tagawa Mine.

These purchases enabled Mitsui to become dominant in the Chikuhō region. Meanwhile, Mitsubishi bought up the Hōjō Mine in Tagawa and purchased a new coal-mining district at Kamiyamada in Kaho County. Mitsubishi thereby became the second largest coal concern after Mitsui.

The characteristics of the modernization of the coal industry in Chikuhō by zaibatsu capital are as follows. First, those companies which ventured into the region had prior experience in either modern coalmines or mine management in general. They thus employed modern miners and mining engineers. Second, their large capital allowed them to hire the necessary Japanese engineers with modern mining skills, personnel which the endogenous mine managers could not easily afford. Thirdly, full-scale modernization by big capital was achieved because of the purchase of coalmines which had already been partially modernized by the endogenous managers.

Although many of the endogenous managers were driven out of business during the launching period of zaibatsu investment, several became major coalmine managers with the establishment of modern mines. Among these were Keiichirō Yasukawa of Meiji Mining (Meiji Kōgyō), as well as Tasuke Kaijima and Takichi Asō. They were the forerunners of the modernization of endogenous mining from the 1880s to the early 1890s. The fact that they exhibited superior ability in management and in labour administration deserves special attention. The reason they were driven out of business, despite their abilities, was that they did not have any affiliation with central capital.

The modernization of the coal industry in Chikuhō during the period of the establishment of Japanese capitalism was thus achieved with zaibatsu capital. The output of coal increased rapidly from the end of the Sino-Japanese War. While the output prior to the war in 1893 (Meiji 26) was 1,230,000 tons, this increased to 2,340,000 tons in 1896 (Meiji 29), and ten years later reached 6,440,000 tons.

As of 1903 (Meiji 36), the output of individual mines reveals that the large coalmines, with an annual production of over 300,000 tons, were

TABLE 21. Coal Output According to Individual Enterprises (1903 - Meiji 36)

Enterprise	Name of Mine	Output (10,000 tons)	Output by enterprise (10,000 tons)	Percentage in Chikuhō
Mitsubishi	Shinnyu	40.8	68.1	13.4
	Namazuta	22.9		
	Kami Yamada	4.4		
Mitsui	Mitsui-Tagawa	45.8	61.0	12.0
	Mitsui-Yamano	15.2		
Furukawa	Shiogashira Shakanoo	34.8	42.5	8.4
	Shimo Yamada	7.7		
Sumitomo	Tadakuma	12.6	12.6	2.4
Kaijima	Ōnoura	36.4	62.5	12.3
	Ōtsuji	26.1		
Meiji	Meiji	45.4	60.4	11.9
	Akaike	15.0		
Asō	Yoshio	4.9	10.9	2.1
	Mameda	6.0		
Kotarō Hiraoka	Toyokuni	18.7	68.5	13.5
The Mori Family	Kanada	15.5		
Yoshitani Kōgyō K.K.	Yoshitani	14.9		
Kumekichi Iwasaki	Iwasaki	10.4		
Kyushu Tankō K.K.	Shinte	5.5		
Tokutarō Nakano	Aida	3.5		
Total for the 20 mines			386.5	76.0
Total Output in Chikuhō			505.6	100.0

Source: Data formulated from Meiji Kōgyōshi, Mining Section, attached table.

the Shinnyū, the Mitsui-Tagawa, the Shiogashira, the Shakanoo, the Ōnoura and the Meiji Mines. These in reality comprised several mines which produced approximately 100,000 tons. It was the objective during the late Meiji and early Taishō periods to introduce large-scale coal mining based upon technical innovation such as the installation of electricity in coalmines and the excavation of large pits.

The Role of the Foreman System During the Modernization Process in Chikuhō

(1) The Concept and General Function of the Foreman System

It has been stated that the endogenous coal-mining industry played a

principal role in the modernization of the coal industry in Japan. In the case of modernization in Chikuhō, a group of miners called foremen played an especially important role. They were the organizers and bearers of the endogenous technology. This section analyzes the actual circumstances of the foremen and examines their role in the modernization of the mining industry.

The foreman system was already established at the beginning of the nineteenth century. At the time of the Meiji Restoration, however, during the developmental process of both the endogenous coal-mining industry and modern coal mining, the foremen developed into an independent category of their own. The foreman system, at least since the Meiji Restoration, was based upon a contract between the manager of a mine and those who were skilled in mining technology. They were contracted to carry out coal extraction and to oversee labour management. Some undertook these tasks in the place of the managers.

The foreman system can be broadly categorized into two major types. The first type was the system where a hired foreman was contracted to be in full charge of the entire mining operation. The foreman was paid a sum of money proportionate to the amount of coal extracted. Although there were cases where the foreman was also an investor, he was solely in charge of the mining operation. In lieu of the manager, he conducted the operation by hiring pitmen to work for him. The pitmen were controlled and supplied under a special labour system called the bunkhouse system. This type of foreman was necessary as the managers were inexperienced and therefore needed a foreman to run the entire operation. This type of foreman system existed from the early Meiji period to the 1890s, at the time of the development of the endogenous coal industry as well as during the formation of modern mines. This type is often called the chief foreman system (Daitōryō sei).

The second type, which developed after the dissolution of the first, was a system whereby a foreman was contracted specifically to be responsible for labour management. This type was functional when the

manager was either experienced in management and technology or capable of directly employing competent personnel for the operation. The foreman's task was thus limited to labour management. This type of foreman existed mainly from the 1880s, under a system called the bunkhouse foreman system (Nayatōryō sei).

When the managers did not yet have sufficient management skills, the foremen were solely in charge of the mines. Consequently, they had to have, first of all, a good understanding of conventional mining technology. Moreover, they were excellent labour administrators who could control and give the pitmen technological instruction. However, there were often gamblers and gangster-types among them, and it cannot be denied that, on the whole, foremen tended to be of this nature. Such tendencies, however, were not fundamental to the foreman system. To equate the foremen, therefore, with gamblers and gangsters is not necessarily correct.

The attached table reveals the number of years that foremen described in "Chikuhō Kōgyō Tōryō Den" [A Biography of Foremen in Chikuhō Mining] worked in coalmines prior to actually becoming foremen. This table shows that they worked in mines as pitmen for an extremely long time, where they learned and mastered mining technology of a high level. In particular, it is also revealed that a longer period was required to qualify for foreman status after the establishment of modern mines.

TABLE 22. Years of Experience as a Miner Prior to Becoming a Foreman

Year of appointment as Foreman \ Years of Experience	1-5 Years	6-10 Years	11-15 Years	16-20 Years	21-25 Years	26-30 Years	Total
Meiji 1- 5	2	2					4
6-10		5	1				6
11-15	2	3	1				6
16-20	1	3	1	1			6
21-25	2	6	2	2	1	1	14
26-30	1	4	12	2	1		24
31-35			5				5
	8	27	22	5	2	1	65

Source: Data formulated from Tōyrō Den by Otomatsu Kodama.

There were various types of foremen, such as those who aimed at becoming entrepreneurs, those who took pride in their skills and functioned as conventional foremen, and those who became bosses through gambling and fighting, which qualified them for the management of labour. The type which played a significant role in the modernization of mines in Chikuho was limited to those who had superior technological skills.

It is also necessary to pay attention to the contractual basis of the foreman system. A foreman was contracted to take full responsibility for labour management, which involved recruitment and supervision of labour as well as supervision of the living conditions of the pitmen through management of bunkhouses. Although such tasks are often perceived as part of the function of the bunkhouse system, foremen of the first type were contracted to take charge of coal mining as well as labour management while foremen of the second type were only responsible for the latter task. The formation of the labour market for miners was not yet sufficiently developed during the period when Japanese capitalism was being established. It thus cannot be said that miners were predominantly controlled by capital. Coalmine managers were not well experienced in the management of labour. At this level, therefore, labour management by foremen had a significant role. The bunkhouse system was functional especially as a means for the technical education of miners as well as for the recruitment of pitmen. As far as labour management was concerned, the modern mines were also greatly dependent upon the bunkhouse system.

(2) The Positive Role of Foremen in the Modernization of Coalmines

The significant role that foremen played in the modernization of coalmines is exemplified in the case of the Shakanoo Mine. Although the owner, Tokusaburō Sugiyama, was an experienced engineer, he was a complete amateur when it came to management of a coalmine. In order to be a modern owner, therefore, he hired foremen to run the operation.

One of the foremen whom Sugiyama hired when he was planning to excavate

a modern mine was Toshikichi Iida. Iida was born in 1837 (Tempō 8) at Gotoku, Kurate County. He began working in a mine from about the age of ten and worked at various mines in different areas. After becoming a foreman at age 19, he moved to Hizen where he learned the endogenous technology as he moved from one mine to another. He was about 54 years old when he was hired by Sugiyama. He was, thus, a veteran chief foreman with more than 40 years' mining experience.

When he was hired, his payment was based upon "a pound-measure-full of 20 sen coins per 10,000 kin of coal, and the income from the bunkhouse." He was thus hired under very good terms, receiving "10 yen a day" (about 300 yen a month). The degree of his expertise in mining is clearly revealed by the following facts. When he resigned from the Shakanoo Mine one and half years later, he was employed "as a practical sub-engineer for a survey of coal reserves conducted by the Imperial Navy" in the Chikuhō region. Subsequently, he was hired as a chief foreman for the modern Hontō Mine by Takasuke Konomi, and as a bunkhouse foreman at Mitsubishi's Shinnyū Mine.

Three other foremen were hired by Sugiyama, of whom Yaichi Uryū is noteworthy. He was born in Kama County and in his boyhood he learned how to write from a temple priest. He thus was one of the few foremen who could read and write. In 1869 (Meiji 12), when he was 16 years old, he went as a migrant labourer to work at a mine in Karatsu. He became bunkhouse foreman at a coalmine in Sasebo at the age of 20. He then worked for one and a half years at the Takashima Mine, and as a bunkhouse foreman at various mines in the Hizen region. He returned home ten years later and was employed as a chief foreman by Sugiyama.

His competence is demonstrated by the fact that he solidified the pit of the Shakanoo Mine "by creating coal pillars which rose precipitously in order to compete against large-scale coalmines." This was accomplished despite strong opposition from the previously-mentioned chief foreman, Toshikichi Iida. Uryū thus introduced the modern pillar method of coal extraction which he had obviously acquired while working for the Takashima Mine. It can be seen that the first modern

mine in Chikuhō was founded and maintained by endogenous miners who had studied modern coal-mining methods at advanced mines. Uryū resigned from the Shakanoo Mine after working there for four years. He subsequently cooperated with Yoshitaka Hoashi in the modernization of the Uruuno Coal Mine. Thus, competent foremen contributed to the establishment of other modern mines. Tsunosuke Tani, who was invited to excavate a new pit at the Tagawa Coalmine, was another capable foreman. He was asked to take charge of excavation when the expertise of a modern mining engineer proved useless. He was born in Tagawa and began working in a coalmine at the age of 13. He was 42 years old when he was employed by the Tagawa Mine. It was said of him that "as far as methods of extraction and ability to manage labour are concerned, he is such a veteran as can be compared to none." "He has trained and produced as many as 47 or 48 honourable foremen to follow him." He was a great foreman with a mining experience spanning nearly 30 years.

What should be remembered here, as previously stated, is the fact that foremen, who acquired modern coal-mining technology while working at the Takashima and Miike mines, later contributed to the establishment and maintenance of the modern mines in Chikuhō. Among the 120 foremen described in the Biography of Foremen, there were as many as 20 (14 at the Takashima Mine) who had worked either at the modern Takashima or Miike mines. Many of them cooperated in the modernization of the mines in Chikuhō.

Rikuhei Matsuoka, for example, who was born in 1852 (Kaei 5) in Tagawa, became a pitman at the age of 19 when the fortunes of his family declined. He exhibited unique talents during the Satsuma Rebellion, and was chosen to become a telegraph operator. After spending some years in the underworld, he became bunkhouse foreman at a large mine in the Hizen region. He returned home after working for the Takashima Mine and became a foreman for Kōtarō Hiraoka's mine in the Chikuhō region. He contributed to the modernization of the Akaike Mine in 1891 (Meiji 24).

As described above, capable foremen aided in the modernization of the mines in Chikuhō. They continued to do so together with modern mining engineers even after modernization by big capital started. Another example is Hachiuemon Abe, a veteran foreman hired by Asō to work for the modernization of the Namazuta Mine. He was born at Namazuta in 1839 (Tempō 10). He was invited to work as a chief foreman even after the Namazuta Mine was bought up by Mitsubishi, and he contributed to its modernization.

The management of the mines by big capital, however, meant an end to dependence upon the technology of conventional foreman, once big capital gained sufficient experience and acquired its own modern mining engineers. There was definitely a limitation on what the endogenous technology could offer when it came to the establishment of full-scale modern mines. In addition, the boss-gang aspects of the foreman system, the sometimes violent means of control of the pitmen, and irrational aspects pertaining to the bunkhouse system placed fetters upon the modern management of coalmines. In consequence, the foreman system, which had played a certain positive role in the modernization of the mines, began to be eliminated by big capital from about the 1900s. Many of the foremen were absorbed as middle- and low-ranking personnel by the coal capital, and their historical mission was completed.

POSTSCRIPT

The modernization of mining during the growth period of Japanese capitalism thus developed on a foundation established by the endogenous mining industry. It was not achieved at a single stroke, but was, instead, a gradual process. Initially, imported technology was of a relatively low standard in comparison to that available in the West. This, however, was convenient as it minimized the gap between modern western and endogenous technology. Thus the endogenous industry could accept and digest modern technology, which resulted in a relatively smooth process of modernization.

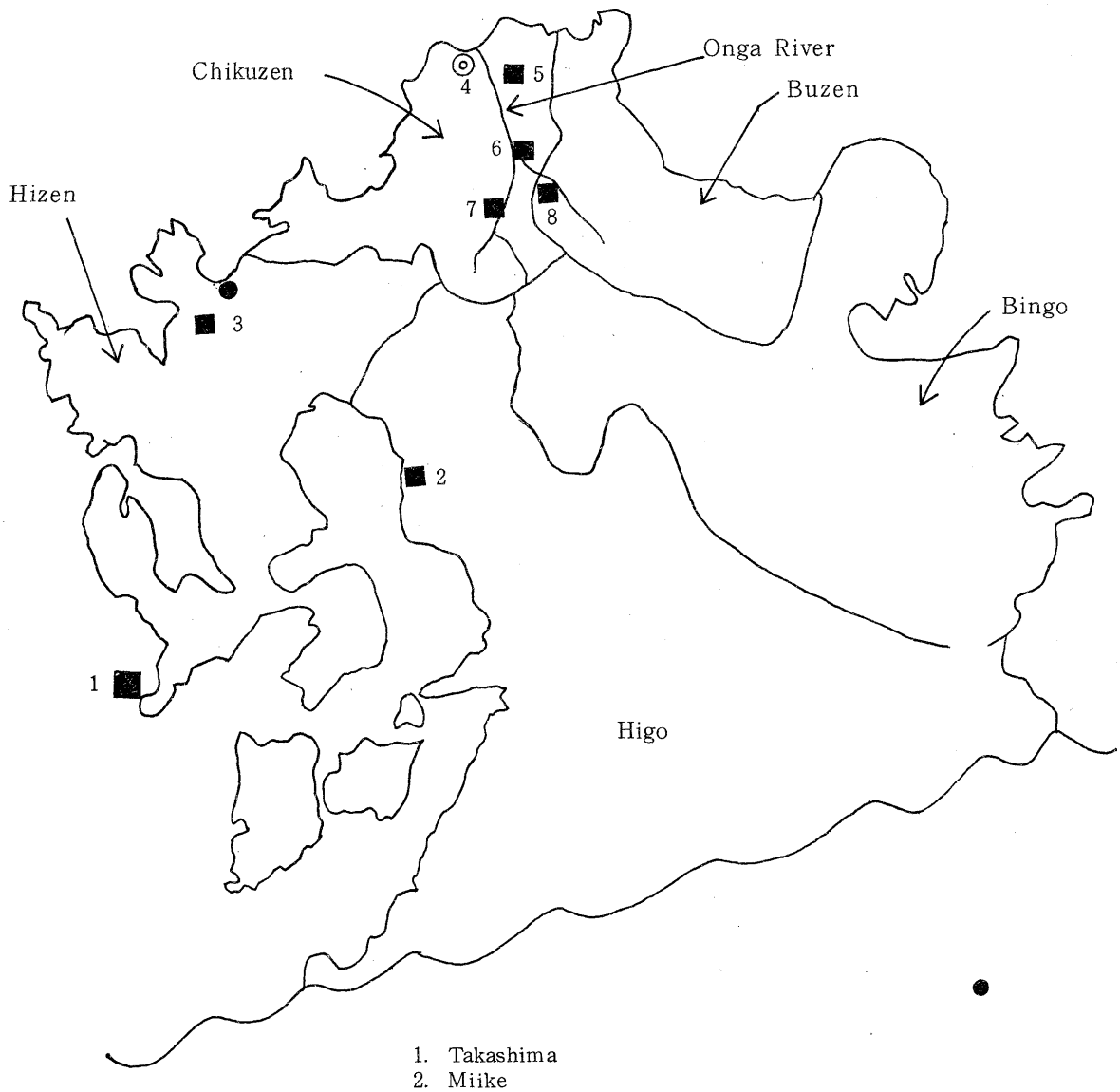
Moreover, creation of the modern machine industry and a conscious effort to nurture modern engineers by the government allowed the modernization of the coal-mining industry in Japan to be pursued self-sufficiently. The gradual process of modernization gave the endogenous industry enough time to absorb western technology as well as to develop the necessary conditions for further advancement. This was, consequently, advantageous for the actualization of independent modernization.

Although there were many problems and contradictions within the mining industry in Japan, nevertheless, an energy source was supplied for modern industry. The modernization of the coal industry corresponded to the development of capitalism in Japan. This paper has specifically examined the use of endogenous technology in the modernization process of mining during the growth of capitalism in Japan. However, there are many other problems which are not dealt with in this paper.

One problem is the relationship which developed between a handful of

privileged entrepreneurs and the government, through the government's policy of enforced capitalism (and subsequent problems related to technological innovation). Other problems were a high rate of accidents due to modernization, and conflicts between labour and management. Furthermore, important problems which, in principle, relate to this paper, such as the modernization of mining in Hokkaido, technological innovations and their influence upon mining since the establishment of capitalism in Japan, and mine management in the former colonies are not examined. These will be themes for future studies.

Main coalmines, cities and regions in Kita Kyushu



1. Takashima
2. Miike
3. Karatsu
4. Ashiya
5. Shakanoo
6. Nogata
7. Namazuta
8. Kanada